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EDITED BY
LEWIS STEPHEN PILCHER, M D, LL D,
OF NEW YORK

WITH THE ASSOCIATION OF
JAMES TAFT PILCHER, B A, M D, .
AND THE COLLABORATION OF
W SAMPSON HANDLEY, M S, M D, F R C S,
OF LONDON

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No 1

DIVERTICULA OF THE ŒSOPHAGUS, PULSION, TRACTION, MALIGNANT AND CONGENITAL*

BY CHEVALIER JACKSON, M D

AND

THOMAS A SHALLOW, M D.

OF PHILADELPHIA, PA

ŒSOPHAGOSCOPIC OBSERVATIONS

BY CHEVALIER JACKSON

Incoordination of the Cricopharyngeal Pinchcock as an Etiologic Factor in Pulsion Diverticulum—The cricopharyngeus muscle is in my opinion an important factor in the etiology of pulsion diverticulum (Figs 1 and 2). These orbicular fibres of the inferior constrictor merge with the circular fibres of the œsophagus. Some anatomists seem to regard them as part of the inferior constrictor and other anatomists seem to regard them as circular fibres of the œsophagus. To the œsophagoscopist, however, the living active muscle looms in huge proportions because so long as it remains contracted, it acts as an impassable barrier to the safe passage of the œsophagoscope. Making gentle pressure with the tube-mouth he waits patiently until the cricopharyngeus relaxes sufficiently to allow the œsophagoscope to enter the œsophagus. No one who examines this region on the cadaver has any conception of the bone-like hardness of the mucosa-covered cricopharyngeus when contracted in a patient who is not under general anæsthesia. This hardness led early œsophagoscopists to think it was the cricoid cartilage that was encountered. The author, however, demonstrated¹ that the resistance was on the posterior wall and was due to the orbicular muscular fibres (Fig 1) that are essentially different in power and action from either the circular fibres of the œsophagus, on the one hand, or the oblique fibres of the inferior constrictor on the other. To the author, looking through the œsophagoscope it is obvious that the oblique fibres remain contracted while the orbicular fibres relax. This constitutes a separate action with distinct innervation that entitles each group of muscular fibres to a separate name. The separate name serves well the study of the mechanism of deglutition and of the technique of introduction of the œsophagoscope. Passing on down with the œsophagoscope nothing similar to the cricopharyngeal constriction is found throughout the entire length of the thoracic œsophagus. It is therefore clear that there is something more powerful at the cricopharyngeal level than in the œsophageal wall. It is not until the hiatus œsophagus is reached that we encounter

* Read before the College of Physicians of Philadelphia February 3, 1925.

like rigidity At this point we have another group of pericesophageal muscles, the diaphragmatic pinchcock musculature of the diaphragm

Whatever may be the anatomist's viewpoint, he who does œsophagoscopy without anæsthesia cannot but feel that it is wrong to class the orbicular fibres at the upper end of the œsophagus as simply part of the circular coat of muscles of the œsophagus, on the one hand, or simply part of inferior constrictor on the other

It is my opinion, based on œsophagoscopic studies, that it is the barrier presented to the advance of the bolus by the unrelaxed cricopharyngeus that

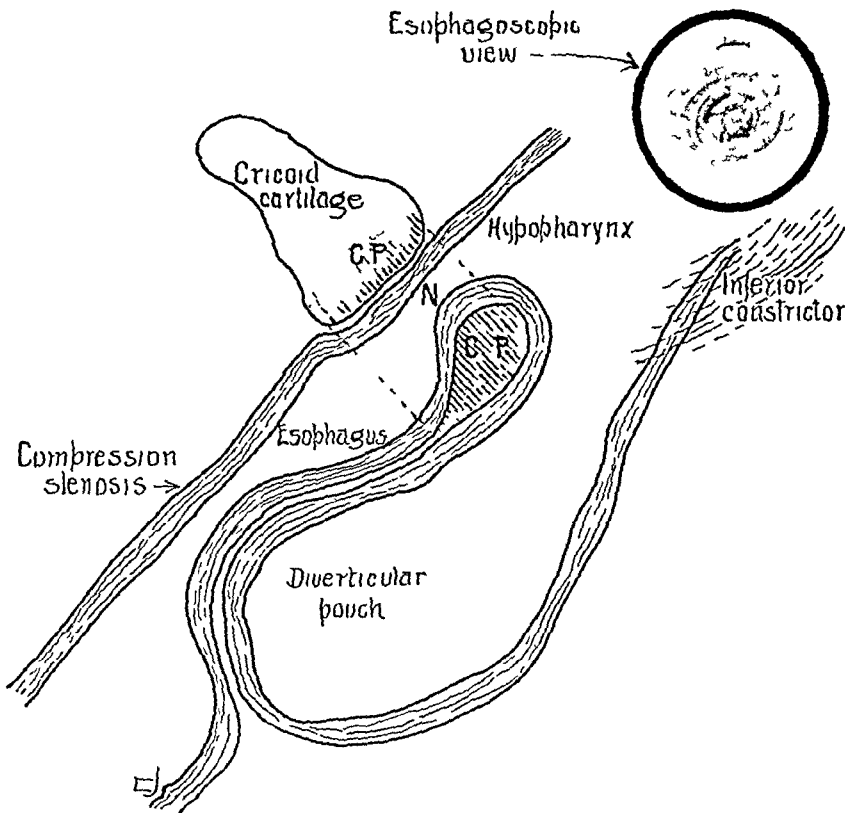


FIG. 1—Schema showing the authors theory of the functional factor in the etiology of pulsion diverticulum. The chief functional etiologic factor is the cricopharyngeus muscle (CP) which normally pulls the cricoid cartilage back against the spine maintaining in health a tonic closure of the œsophageal mouth (N). The abnormal etiologic factor arises when the cricopharyngeus fails to relax at the approach of the bolus propelled by the powerful contraction of the inferior constrictor the powerful squeezing muscle. The structural factors demonstrated by Mosher are doubtless of equal or greater importance. This drawing also illustrates the secondary compression stenosis which, along with the enlargement of the pouch and the increased deglutitory pressure, constitutes the vicious circle on which inevitable increase of dysphagia and discomfort depend. In the œsophagoscopic view the cricopharyngeus muscle, CP, is concealed under the mucosa between the diverticular pouch shown below and the slit-like orifice of the subdiverticular œsophagus shown at the top of the circular field of vision.

in cases of so-called cardiospasm, which is due, in many cases at least, to failure of the diaphragmatic pinchcock muscles to relax, in other words, a pathologic mechanism analogous to that present in pharyngeal diverticulum. Summing up the matter, the essential mechanism is not so much the propulsion of the oblique fibres of the inferior constrictor as the failure in the coordinate obliteration of the normal obstruction ahead.

In a number of our cases of pulsion diverticulum organic stricture in the

is the functional factor that herniates the pharyngeal wall, thus creating the pharyngeal diverticulum. The wall of the hypopharynx and œsophagus is weak everywhere, but is as strong here as elsewhere, and seems better supported in the neck than in the case of the thoracic œsophagus. But the thoracic œsophagus does not have the obstruction ahead except

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rifice has required œsophagoscopic dilatation. Because of the coordinate failure of the cricopharyngeal pinchcock to open seeming an important factor in etiology, it has seemed to us advisable to stretch the cricopharyngeal constriction gently even when not organically strictured, to lessen the tendency to recurrence. This cannot be done with the same vigor as in the case of the anal sphincter at a hemorrhoidal operation. The passage of the largest sized œsophagoscope is usually sufficient, and is safe in careful experienced hands. This has, we believe, been an important factor in the prevention of

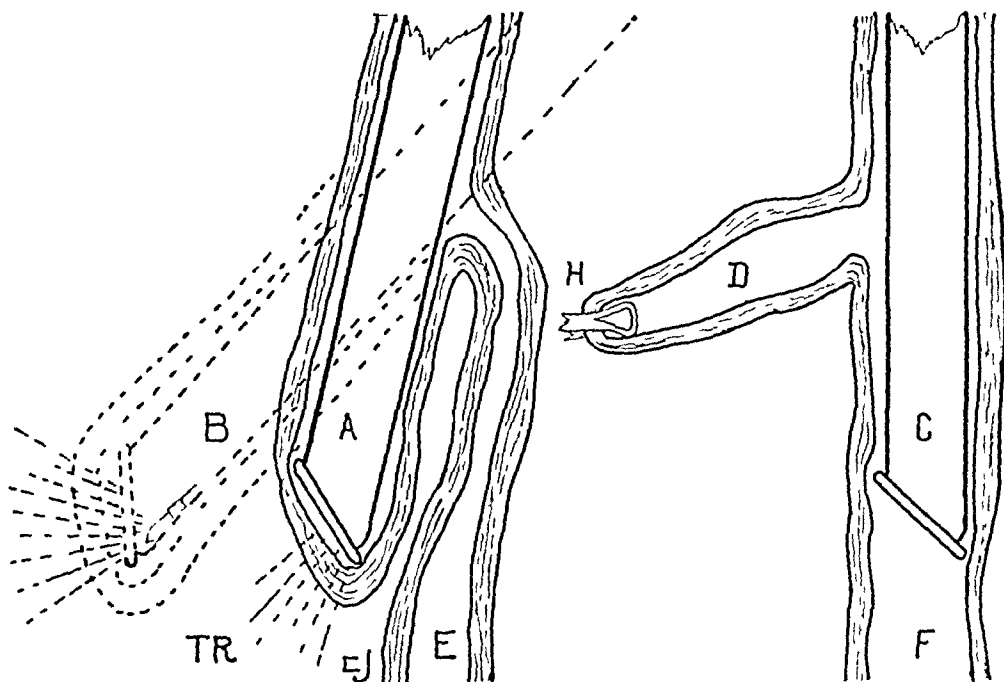


FIG. 2.—Schematic representation of œsophagoscopic aid in the excision of a diverticulum. At A the œsophagoscope is represented in the bottom of the pouch after the surgeon has cut down to where he can feel the œsophagoscope. Transillumination (TR) from the œsophagoscopic lamp greatly assists the surgeon in identification of the sac. Then the œsophagoscopist causes the pouch to protrude as shown by the dotted line at B. After the surgeon has dissected the sac entirely loose from its surroundings he makes traction upon the sac as shown at H and the œsophagoscope is inserted down the lumen of the œsophagus as shown at C. The œsophagoscope now occupies the lumen which the patient will need for swallowing. It only remains for the surgeon to remove the redundancy without risk of removing any of the normal wall.

post-operative leakage and in prevention of recurrence of pulsion diverticulum, in our cases.

The mechanism of so-called traction diverticulum is essentially different (Fig. 4). The absence of anything corresponding to the cricopharyngeal pinchcock accounts for the well-known clinical fact that traction diverticula are usually unaccompanied by dysphagia.

ŒSOPHAGEAL DIVERTICULA FROM THE SURGEON'S VIEWPOINT

BY THOMAS A. SHALLOW

Diverticula of the œsophagus are not increasing in frequency but the diagnosis is now made much more certainly than formerly. Diverticula used to be missed they are now discovered. The improved methods of diagnosis—the œsophagoscope, the fluoroscope and roentgenograms—enable us to recognize this operable form of dysphagia and to distinguish it with certainty from other often inoperable forms. Hence diverticula are now more frequently recognized.

In contrast with the certainty of present-day diagnosis, the older literature shows many cases in which the cause of the dysphagia was never recognized during life and in which a post-mortem examination disclosed a pulsion diverticulum.

Much has been said of the etiology and of the morphological characteristics of oesophageal diverticula. Two types of diverticulum of the oesophagus are accepted by authors, viz., (a) the pulsion type, (b) the traction type.

We desire to point in this paper to several unusual forms of diverticula—

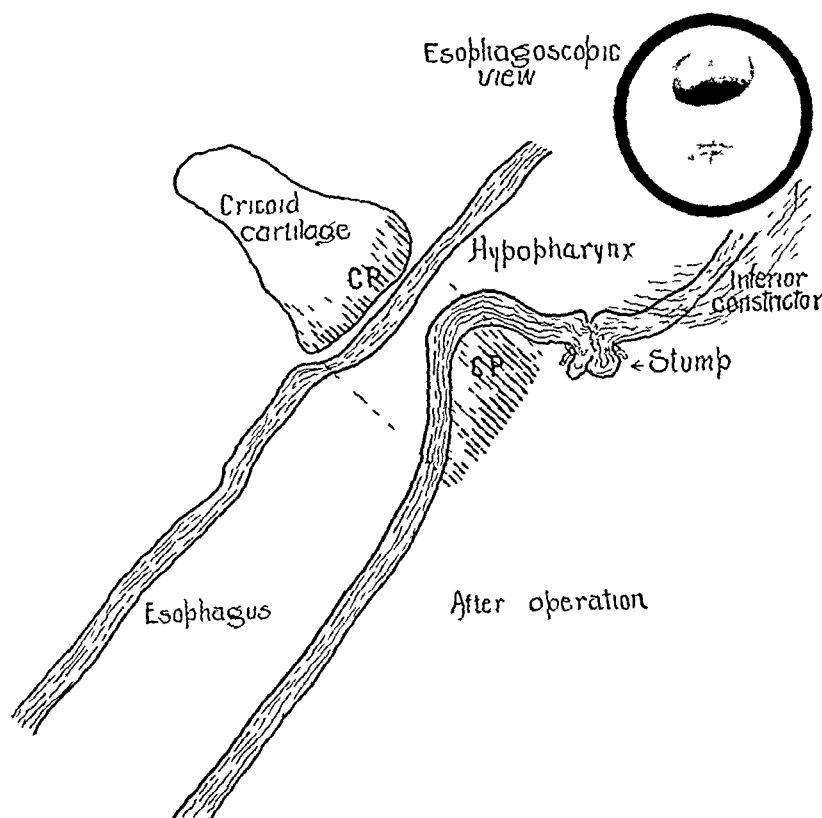


FIG. 3.—Schematic illustration of post-operative conditions illustrating the advisability of oesophagoscopic stretching of the cricopharyngeus muscle CP. The inferior constrictor, the powerful squeezing muscle, propels the bolus in the direction of the subdiverticular passage, (N Fig 2) surrounded by the cricopharyngeus muscle CP, to reach the oesophagus. If the cricopharyngeus fails to open promptly, widely, and coordinately, enormous pressure is put upon the stump of the removed diverticulum, causing in some cases leakage before and recurrence after healing. Overactivity of the cricopharyngeus is obviated by careful oesophagoscopic stretching at operation. In addition to the incoordination referred to the structural factors demonstrated by Mosher contribute to the primary etiology. This illustration shows the stump before invagination.

that William Boyd² states that congenital diverticula do not exist. If this view of Boyd's is correct, then, of course, we are wrong, and we must try to determine—with what we are dealing? Is it a traction diverticulum or is it the hypertrophied remains of one of the branchial clefts? With these thoughts in mind we present the case.

CASE I—J B, male, age eight years, was admitted to the surgical service of Prof. J. Chalmers DaCosta with fever, flatness of the right side of chest and all the physical signs of empyema. Following a rib resection for the evacuation of pus which was present, he discharged particles of food through the external chest wound. Because of his very poor condition and the necessity of a gastrostomy, which was done, oesophagoscopy was delayed until the symptoms of sepsis subsided. The patient died fourteen days

(1) the congenital form, (2) the double diverticula, and (3) a form in which malignancy is a contributing cause. We will question the accepted view—that diverticula do not occur before middle life and will present a case in which symptoms of a diverticulum existed in a boy at the age of twelve years.

Congenital Diverticula—In presenting a case which we believe to be one of congenital diverticulum, we realize

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After the operation without diagnostic œsophagoscopy and the clinical diagnosis of perforation of the œsophagus was made. Post-mortem examination by Dr Baxter L Crawford disclosed a narrow tube springing from the posterolateral wall of the œsophagus, 11 cm from the laryngeal opening, extending downward and backward. The tube was $2\frac{1}{2}$ cm long, 4 cm in diameter, and of equal calibre throughout its entire length. The course of the tube was downward and outward. The distal end opened into the chest cavity through the dome of the pleura, thus explaining the cause of the empyema and the reason for the food passing through the thoracotomy wound. Microscopic examination of this tube showed its wall to be in three distinct layers, corresponding structurally to those of the œsophagus and hence our decision that the tube was a true diverticulum (Fig 5). Sections made at various levels of the tube showed the same distinct layer arrangement of mucosa, submucosa and muscular fibres. This fact, in conjunction with the almost right angle connection of the tube with the œsophagus and the absence of any inflammatory changes in the œsophageal wall or near the junction of the tube to the œsophagus, lead us to discard the diagnosis of traction diverticulum. To account for this unusual condition we, therefore, should consider the possibility of a pharyngeal branchial fistula as a causative factor.

Maylard¹ states that a congenital diverticulum may be caused by the persistence of one of the branchial clefts. We are told by Von Beigmann¹ that a persistent branchial cleft, with the resultant cyst or fistula, involves the second cleft only, the course of the cyst or fistula being between the internal and the external carotid arteries.

The internal landmark of a second branchial cleft is in the pharynx behind the tonsil at which point the fistula may open into the pharynx. If an external fistula is present the cutaneous opening is along the anterior edge of the sterno-mastoid muscle. Thompson¹ states that internal openings due to perforation of the third or fourth cleft membranes are infrequently seen but when present they open lower down in the sinus pyramidalis. He further states that the course of the tract of the third cleft is below the internal carotid artery and above the superior laryngeal nerve. The same author says that theoretically a fourth cleft should pass downward on the right side it should hook around the subclavian artery and on the left side it should hook around the aorta. Thompson remarks in his article that he is not familiar with any observation showing a fistulous tract passing around the subclavian artery or the aorta. Let us compare the morphology of the wall of a fistula of the second branchial

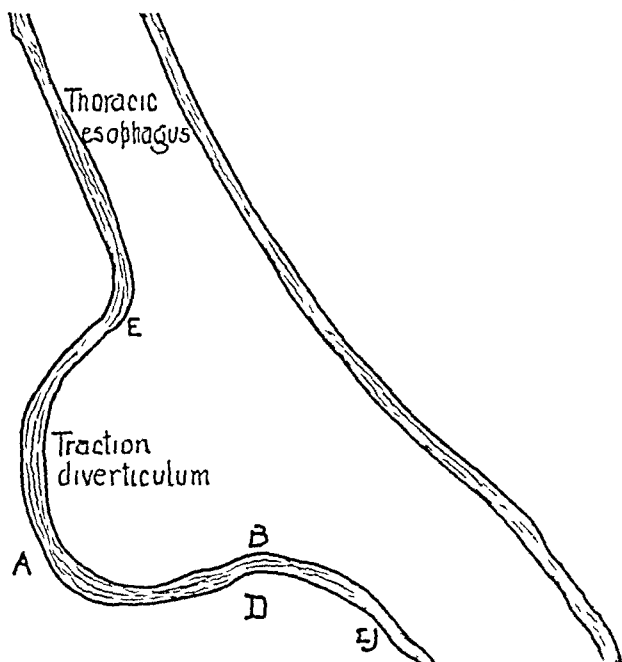


FIG. 4—Schematic illustration of the classic type of traction diverticulum due, or supposed to be due to traction of a scar external to the œsophageal wall at A. It has been supposed that the reason such diverticula are symptomless is that the lower rim of the pouch B is as low as the bottom of the sac or at least lower than the upper rim of the entrance to the pouch C. In the authors' opinion, however, the true reason lies in the anatomical fact of the absence of an orbicular muscle at D to act analogously to the cricopharyngeus which in the authors' opinion is a powerful factor in the etiology of pulsion diverticula. (Compare with the cricopharyngeal pinchcock CP Fig. 1.)

cleft as found in the case of Seelaus⁹ with that of the supposed congenital diverticulum which we report

"Specimen consists of a small tubular structure measuring 6 cm in length. The average diameter is 0.75 cm. At one extremity there is a small pin-point opening and on cross-section there is a lumen throughout the length of the specimen with average diameter of 0.5 cm. The lumen, however, is much smaller in some places than in others. Formalin fixation.

"*Histology*—On cross-section the structure is found to possess a definite lumen which is lined with stratified squamous epithelium and just beneath this epithelial lining in places there are collections of lymphoid tissue and also a few mucous glands are observed. There is a definite fibrous tissue coat forming the main portion of the wall of the fistula, but no muscle is observed except fragments of striated muscle attached externally. The mucosa is inflamed and ulcerated and in places the lumen is filled with necrotic material and leucocytes, many of which are polymorphonuclears. Sections were taken from various portions of the structure and the epithelial lining is constant.

"*Diagnosis*—Squamous epithelial lined fistula.

"Microscopic examination of cross-section of congenital diverticulum showed same to be lined with stratified squamous epithelium and a thickened submucosa. Muscular coat is well developed" (Fig 5).



FIG. 5—Microphotograph of cross section of congenital diverticulum existing in a boy eight years of age showing the distinct mucous coat and part of the muscular coats. The entire specimen is of the same calibre throughout.

from the second cleft. There are no recorded cases of fistula of the third or fourth clefts to compare with the structure found in our case. It is also noted that the opening into the œsophagus in our case is far below the point where Thompson states the third and fourth clefts should open. We therefore, assume that we are dealing with a true congenital diverticulum.

Juvenile Diverticula—The common view that diverticulum of the œsophagus does not exist before the fortieth year is shaken by the following case. Dr D W, male, age fifty-four. Doctor W stated that when a youngster on a farm he amused the other boys by regurgitating grapes which he had swallowed a number of hours before. During the period of forty years from the time he came to operation, he had the classical symptoms of diverticulum of the œsophagus with the exception that he did

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not begin to lose weight until very recently. He accounted for this by the fact that after filling the sac with food he was able to swallow without difficulty. X-ray examination by Doctor Manges disclosed an œsophageal diverticulum at the pharyngo-œsophageal level. The sac is a little to the right in the median line and almost entirely on the posterior wall. Figure 6 will show the size and location of the sac.

This unusual history given by a practicing physician from one of the large cities of New York State leads us to believe that diverticulum of



FIG. 6.—*Juvenile diverticulum*. Present symptomatically for forty years prior to operation. The symptoms were first noticed when patient was twelve years old by his trick of voluntarily regurgitating grapes which he had eaten a number of hours before.

the œsophagus may exist in some cases long before the fortieth year, and because of the trivial symptoms manifested remain undiagnosed for years. Therefore, in order to emphasize the possibility of early origin, we have classified this case as a juvenile diverticulum.

Double Diverticula.—Great emphasis has been placed by various writers on diverticulum of the œsophagus on the supposed causative factor. They all agree that there is a congenital weakness at Lamer's triangle. This congenital weakness should be regarded as being at least a part factor in the production of diverticula. That some other factor or factors are connected

in the production of diverticula is unquestionably true, otherwise multiple diverticula could not form. In the case we are now presenting we show by the X-ray picture a double diverticulum (Fig 7). We present a second plate to show the second diverticulum existing after the removal of the first (Fig 8).

P. B., male, age sixty-five. The chief complaints are difficulty in swallowing and the loss of sixty pounds in weight. The present illness dates back twenty years, at

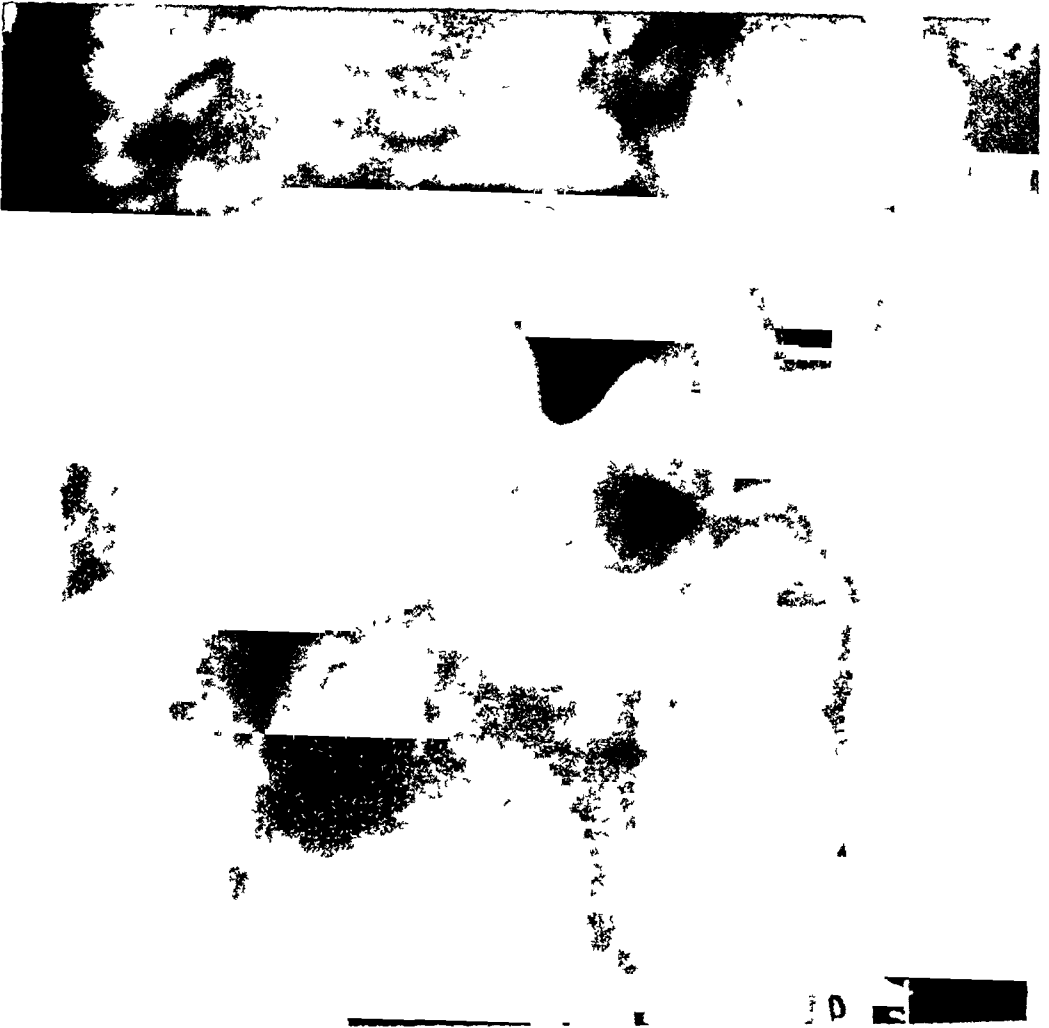


FIG 7—*Double diverticulum*. Showing one pouch filled and the other pouch filling. Prior to operation this patient was able to return two full glasses of water. It will be noticed in this picture that one pouch presents on the left side and the other pouch on the right side.

which time the patient first noticed that he was able to regurgitate food that he had eaten some hours before. He fixed this date absolutely in his mind because he moved from one part of Pennsylvania to another at this period, which he states was twenty years ago. During the past three years he noticed increasing difficulty in swallowing food and a peculiar noise in his throat when eating so that he was compelled to eat alone. He was treated by many physicians for various conditions. A diagnosis of diverticulum was made. X-ray examination by Doctor Manges shows "Quite a large diverticulum of the œsophagus which has two distinct pouches, the smaller one and the higher

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extends toward the left and the larger one is more nearly in the median line, presenting toward the right posteriorly”

Operation—Preliminary gastrostomy was performed under local anaesthesia. After an interval of ten days he was operated upon by the combined method. The diverticulum presenting on the left side was exposed and found to extend down to the suprasternal notch. The capacity of this sac was six ounces. The oesophagoscopy examination by Doctor Jackson during the course of this operation disclosed two openings, one above the other, with no communication between the sacs. In other words it was not a

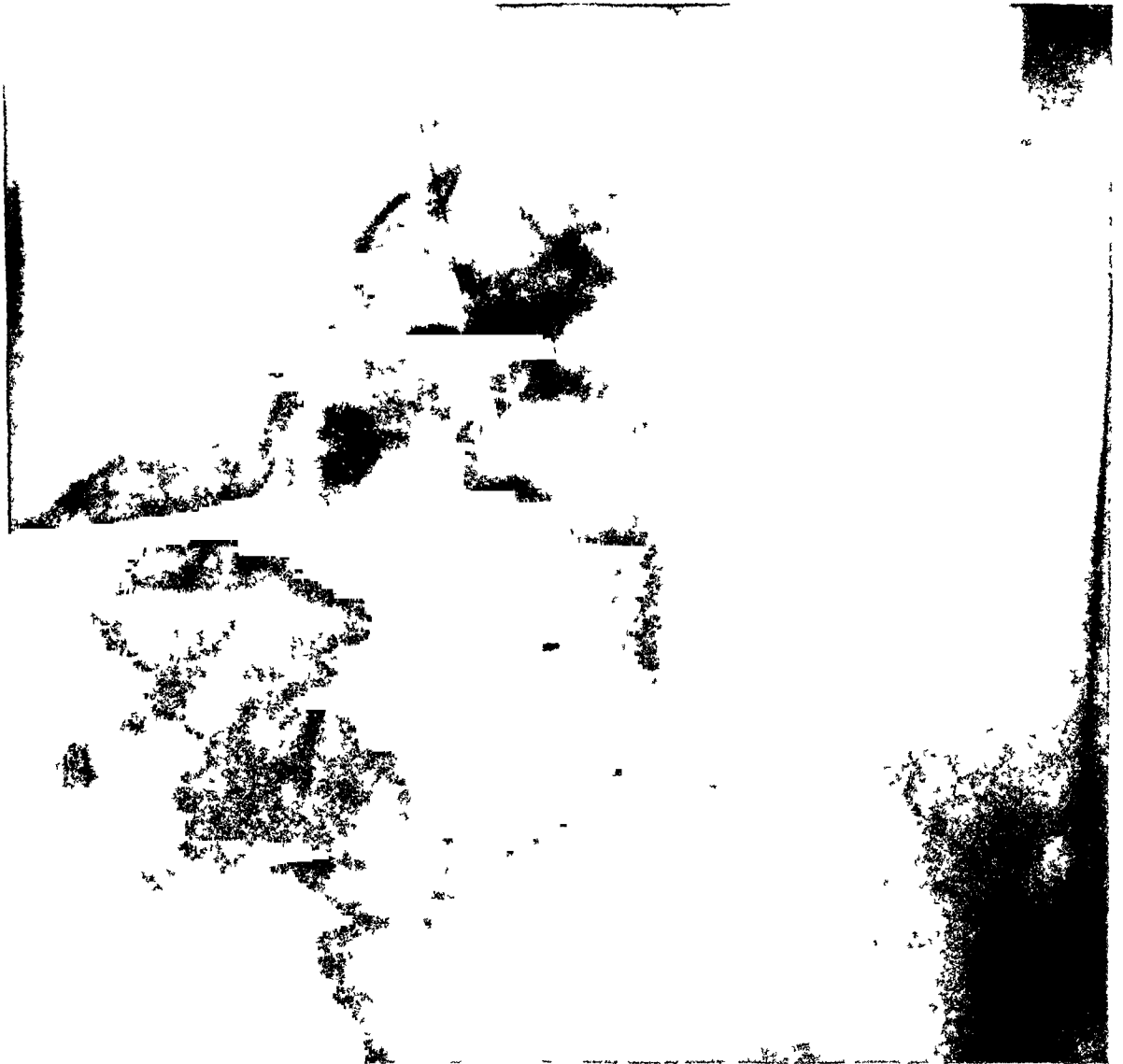


FIG. 8.—Double diverticulum. Showing the left pouch remaining after the removal of the right pouch shown to exist in Fig. 7.

multilocular single diverticulum but each sac sprang from an independent site. Figure 8 shows the remaining diverticulum after removal of the first. Ten days following the removal of the first diverticulum the right side was operated upon by the combined method. The fundus of the diverticulum was adherent to the dome of the pleura and to the subclavian vein. The neck of the sac seemed to expand as it approached the oesophagus. A glance at the first plate showing the presence of both diverticula will make evident the broad bumpy surface present in the picture. The sac was cupped close to the oesophagus. The procedure was a one-stage operation.

diverticulum on the right side which extended into the chest cavity, and was probably a recurrence and not a sac missed at the former operation. He was again operated on by the combined method, and it was found by Doctor Jackson that the opening was toward the right, probably in the region of the original right-sided diverticulum. In exposing the fundus of the diverticulum in the chest cavity and in order to protect the innominate and subclavian vessels, it was necessary to use in the root of the neck, an abdominal retractor with a two and one-half inch blade. It was found that the fundus of the sac was adherent to the arch of the aorta from which structure it had to be cut by long-

handled gynecological scissors. The parts were illuminated by the light of an additional bronchoscope passed along the retractors in the root of the neck, thus direct vision could be employed. The sac was amputated at its junction with the œsophagus. It was a one-stage operation. The mediastinum was protected by iodoform gauze and a small cello-silk drain was introduced.

There was much more reaction from this operation than from any of his previous ones. He was fed through a Rehfuß tube by way of the nose for eighteen days, at the expiration of which time the tube was removed. The patient is now swallowing without any



FIG 9—*Malignant diverticulum*. Showing the existence of a diverticulum which showed malignancy. A distinct pouch with irregularities in its base. It will be observed that this pouch is much lower than the pulsion diverticulum. Pouch with the œsophagus extirpated.

difficulty, six months after the operation, and we hope that a permanent cure has been obtained.

Malignancy as a Cause of Traction Diverticulum.—To consider the two previous cases, one of which existed for forty years, and the other for twenty years is to wonder why malignancy does not occur in diverticula more frequently than has been reported. In presenting this case we do not wish to give the impression that we are dealing with a pulsion diverticulum which had undergone malignant changes, but to show that if the sac preceded malignant growth that it was a traction diverticulum and also to point out the uncertainty of even X-ray diagnosis and the necessity for œsophagoscopy.

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The case is presented in this series to emphasize the absolute necessity of œsophagoscopic study previous to any operation of this nature on the œsophagus. The results of the œsophagoscopic examination were absolutely conclusive. The specimen removed for study disclosed a squamous-cell epithelioma.

J. T., male, age sixty. The chief complaints are difficulty in swallowing solid food, loss of weight, intermittent pains across the sternum and slight hoarseness. The present illness dates back

only eight weeks at which time the patient first noticed difficulty in swallowing solid food. With the onset of this condition he began to regurgitate food. The X-ray examination was made by Doctor Manges. "There is an organic lesion on the upper end of the œsophagus at the level of the supra-sternal notch, a little lower than the usual site of a diverticulum, but there is apparently a diverticulum present. The lower border is irregular. I suspect there are adhesions. We believe it is a diverticulum, but we are unable to exclude a possible infiltrating growth" (Fig 9).



FIG 10 —*Traction diverticulum*. Showing the existence of a cervical traction diverticulum which was not extirpated but anchored to the deep cervical fascia.

The results of the œsophagoscopic examination and the laboratory report of

the specimen influenced Doctor Jackson to advise a preliminary gastrostomy and the removal of the upper part of the œsophagus, including removal of the diverticulum.

Under intratracheal ether anæsthesia the œsophagoscope was introduced so that it passed below the level of the growth. A collar incision was made in the neck, the recurrent laryngeal nerve of the left side was isolated and drawn outward. The left lobe of the thyroid gland was removed and the œsophagus was exposed. At the supra-sternal notch the œsophagus was found to be densely adherent to the fascia at the fundus of the diverticulum. I believe it to have been a traction diverticulum, and I believe so because of the dense adhesions surrounding the œsophagus at this point. With the

œsophagoscope in position in the œsophagus, we exposed the normal œsophagus two inches below the suprasternal notch. The œsophagoscope was then withdrawn the œsophagus was ligated, was severed below the growth nearby and the distal end was invaginated. The upper portion of the œsophagus was removed to its origin. At this point it was ligated, but it was impossible to get a perfect invagination.

Iodoform gauze was used to protect the mediastinum from any leakage from the upper end of the pharynx. The patient reacted well from the anæsthetic and made an uneventful recovery. It is now a number of months since the operation and is yet he shows no sign of local recurrence of the growth. He has gained in weight and is being fed through the gastrostomy opening.

We believe that the carcinoma caused a traction diverticulum.

Pulsion Diverticula.—Our experience with pulsion diverticula leads us to say that they do not all spring from the one narrow location usually assigned to them. Some are lower than others. We have noticed that they may arise irregularly in an area about one-half inch below the junction of the pharynx and the œsophagus. Von Bergmann calls sacs arising at this low level deep œsophageal diverticula. (Dr G. Lotheissen in *von Bergmann's System of Practical Surgery*, American edition. Edited by Dr W. T. Bull.)

The pouch originates on the posterior aspect of the œsophagus and usually advances toward the left or right, usually to the left and gradually increases in size. With the increase in size the œsophagus may be drawn upon and partially rotated on its longitudinal axis. When rotation arises swallowing becomes more difficult and the diverticulum increases more rapidly in size. May not rotation of the œsophagus account for the variation in the size of the diverticulum in different patients? That the sac does not develop toward the left side of the neck in all cases is exemplified by several of our patients. In these the sac was found on the right side of the neck. This fact is of some importance from a surgical standpoint. The operation should be done on the side of the neck on which the sac presents, because with the rotation of the œsophagus toward the side on which the sac is more pronounced, one is able to obtain a better exposure for repairing the opening in the tube.

Complications of the operation for pulsion diverticulum of the œsophagus are: 1. Insufflation pneumonia, caused by manipulating a partially filled sac, and squeezing out semiputrid contents. Many septic particles are inhaled from large diverticula. 2. Mediastinitis, due either to primary soiling of the wound in manipulating the sac, or to leakage from the site of the amputation of the sac during convalescence. 3. Secondary hemorrhage from one of the thyroid arteries exterior to the thyroid gland or from vessels of the gland itself. 4. Œsophageal fistula may follow an operation on a sac may reform. 5. Recurrence of the diverticulum.

Operation.—We believe the employment of the œsophagoscope as an aid to the surgeon simplifies the operation to such an extent that the use of this instrument is almost indispensable. (Fig. 7.) The œsophagoscope, by transillumination of the sac and by lifting it from its bed permits the operator

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o quickly pick it up. The sac is emptied by aspiration through the œsophagoscope and foreign material, such as foreign bodies (in one case there were pieces of an oyster shell) and retained food and secretions are removed. By this procedure the danger of aspiration pneumonia is practically eliminated. This method of operation is known as the Gaub-Jackson⁷ operation (Fig 2.)

After the delivery of the sac the œsophagus is examined at intervals by the œsophagoscope in order to detect the presence of any deformity of the gullet below the diverticulum. It is sometimes noticed that there is a constriction below the diverticular opening. If found, this stenosis must be treated by the surgeon during the suturing of the œsophagus. Finally, in reinforcing the œsophageal walls by sutures, the danger of causing too much narrowing of the œsophagus is prevented by the œsophagoscope being left in position within the lumen of the œsophagus, until suturing has been completed (Fig 8.)

The danger of infection during operation is to a great extent eliminated by the thorough emptying of the sac through the œsophagoscope so that when the amputation of the sac is performed there is little danger of contamination. The danger of the development during convalescence of infection from the site of closure of the neck of the diverticulum formerly gave us very great concern, so much so that it was our habit to employ preliminary gastrostomy for feeding during this period. We have abandoned this precaution and feed all of our patients through a Rehfuß tube left in position through the nose and in the stomach during the entire convalescence. This suggestion was made by Dr F. O. Lewis and Dr Louis H. Clerf.

In this series of cases we have used in some the one-stage operation and in others the two-stage operation with fixation of the sac. As the result of our experience we believe that the one-stage operation, with the aid of the œsophagoscope and with the use of the Rehfuß tube, is the safest and gives the best results.

Technic of Operation—Under intratracheal ether anæsthesia the patient is prepared in the usual manner and an incision is made on the side on which the sac presents and along the anterior border of the sterno-mastoid muscle. The cut is to reach from the level of the hyoid bone to one inch above the sternum and is to pass through the skin and deep fascia, exposing the anterior belly of the omo-hyoid muscle. This muscle is then to be divided transversely. In this cut the external jugular vein may be exposed, and if it is, it should be divided and tied. The common carotid artery and the internal jugular vein are now exposed and retracted outward. If the thyroid gland is decidedly enlarged, it is sometimes necessary to ligate and cut the superior thyroid artery. The trachea and the œsophagus will be found to be encased in a common sheath, which is to be incised, exposing the œsophagus in the posterior part of the wound and the trachea in the front. The trachea is then retracted toward the midline.

The œsophagoscope is introduced by Doctor Jackson or one of his asso

ciates. Dr. Louis H. Clerf or Dr. Gabriel Tucker. The sac is emptied of its contents by aspiration, thereby avoiding squeezing the fluid into the pharynx. The œsophagoscope is then introduced into the bottom of the diverticulum and the sac transilluminated, and the œsophagoscopist rotates the sac into the wound. The sac is grasped with the Babcock clamps and drawn further upward and outward. It will be found at this point that the sac is sometimes covered by a thin layer of muscle. This muscle is separated. The sac is then freed to the junction of the diverticulum with the œsophagus, being careful to free all muscle fibre from its covering. The neck of even the largest diverticulum is seldom one-half an inch in diameter. A neck apparently larger than this usually means incomplete dissection, the genuine neck not having been reached. The sac is then transfixed with a small intestinal needle carrying No. 1 iodized catgut in much the same way as a hernia sac is transfixed, and is secured close to the œsophagus. By this method no leakage occurs during section.

We believe that the mere amputation and ligation of the sac without preliminary transfixion and ligation are not sufficient to cure a diverticulum of the œsophagus. After transfixion, ligation and amputation, we reef the area of gullet around the base of the stump by the use of three sutures of catgut, inserted at intervals each one picking up the muscular coat of the œsophagus. These stitches cause inversion. Some surgeons use a purse-string stitch, but if the opening is large it is impossible to cover the stump by this method. Simple reef stitches at several points of the circle invaginate the stump easily and firmly. By leaving the ends of the reef stitches long enough the suture line can be reinforced by the ends carried across and tied to the opposite ends. This narrows the œsophagus to a certain extent, and if the œsophagoscope was not *in situ* during the suturing the danger of narrowing would be decided. The musculature upon the sac which was separated in freeing that structure is then sutured with No. 1 gut over the embedded stump not so much to secure strength, as to give an additional protection against leakage during the first few days. The incision in the neck is closed in layers, no drainage being used except a small piece of cello-silk placed beneath the deep fascia.

We do not use tube drainage or gauze drainage. A rubber tube may make pressure on the thyroid gland and be responsible for secondary hemorrhage. This is especially apt to be the case if the patient is restless or has severe spells of coughing. A number of the cases we operated upon for œsophageal diverticulum had chronic bronchitis before the operation and during the post-operative period coughed up a considerable quantity of muco-purulent matter. One of our patients developed secondary hemorrhage from this cause. We believe that gauze tends to produce leaking and a fistula in the same way as it does after an operation for vesico-vaginal fistula or suturing the ureter.

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CASE REPORTS

CASE I—Male, J B, age eight years This case was discussed in the general text of this paper as a congenital diverticulum

CASE II—Male, D W, age fifty-four years This case was discussed in the general text under juvenile diverticulum

CASE III—Male, P B, age sixty-five years This case was discussed in the general text of this paper as a multiple diverticulum

CASE IV—Male, J T, age sixty This case was discussed in the general text of this paper as a malignant traction diverticulum

CASE V—Male, H E, age sixty-eight years Chief complaint, difficulty in swallowing any dry solid food This condition has existed for the past year and within the past few months has become more pronounced He is conscious of gurgling noises in the throat particularly after eating There is nothing in the family or personal history that could bear upon his case except that he had typhoid fever fourteen years ago He has lost considerable weight, the exact amount he is unable to determine Œsophagoscopy and X-ray examinations were made by Doctor Jackson and Doctor Manges Doctor Manges says there is a small diverticulum of the œsophagus at the level of the seventh cervical vertebra on the posterior wall in the median line

Operation—No preliminary gastrostomy was done but the combined œsophageal operation by Doctor Jackson and Doctor Shallow, disclosed a small sac Because of the patient's general condition it was deemed advisable not to amputate the sac at the preliminary operation but to leave it for a secondary operation The sac was, therefore, freed and surrounded by gauze On the eighth day the sac sloughed and left a discharging sinus This fistula discharged for a number of weeks but finally closed without any secondary operative intervention

Post-operative Progress—The patient remained in the hospital three weeks after the operation The fistulous tract had not entirely healed on discharge but was healing rapidly He was seen the following month and the neck was entirely healed There has been no further trouble with this diverticulum

CASE VI—Male, F D P, age fifty-six years Chief complaints are, lodgment of food in the neck and noisy deglutition The first intimation that the patient had as to any obstruction in his œsophagus was two years ago when he spat out a watermelon seed he had eaten a number of hours before X-ray examination by Doctor Manges discloses a diverticulum of the œsophagus, perhaps a little to the left of the median line, it has rather a narrow opening and the sac holds about one-half an ounce Œsophagoscopy examination by Doctor Jackson confirms the X-ray diagnosis as to the size and location Operation No preliminary gastrostomy The combined Gaub-Jackson operation by Doctor Clerf and Doctor Shallow Primary amputation of the sac, reinforcement of the œsophagus Closure except for small piece of cello-silk beneath the deep fascia

Post-operative Treatment—The patient was fed through the nose by means of a Rehfuß tube, passed into the stomach and retained for eighteen days Stitches and cello-silk removed on the tenth day Primary healing of the wound X-ray examination on the sixteenth day by Doctor Manges disclosed no evidence of diverticulum, but a slight narrowing of the œsophagus at the site of the original opening of the sac

CASE VII—Female, Mrs E D, age sixty-two years Chief complaint, regurgitation of particles of food several hours after eating Clicking sensation on swallowing Trouble has existed for past five years She has been treated by numerous physicians for "nervousness" She has lost about twenty pounds X-ray examination by Doctor Manges disclosed a rather large diverticulum of the œsophagus a little higher than the average, apparently just a little below the larynx Œsophagoscopy examination by Doctor Jackson disclosed an opening about in the site shown by the X-ray Operation

Combined Gaub-Jackson two-stage operation The sac was found to be large and at outer surface adherent to the right side of the neck The outer surface was composed of muscle which had much the appearance of the constrictors of the pharynx Owing to the large size it was deemed advisable to do a two-stage operation The sac was surrounded by gauze (iodoform) and the wound was left open On the tenth day secondary operation was done with closure of the opening, which was on the lateral wall of the pharynx

Post-operative Treatment—Patient was fed through a Rehfuß tube as was Case VI for eighteen days after the completion of the second operation X-ray examination following the second operation did not disclose any evidence that a diverticulum had ever existed

CASE VIII—Male, L R, age forty-seven years Chief complaints, difficulty in swallowing solid food, regurgitation of food, and noisy deglutition X-ray examination disclosed a moderate sized diverticulum of the œsophagus at the usual location The sac is very little more than one inch in diameter Operation Combined Gaub-Jackson method by Doctor Jackson and Doctor Shallow The sac was exposed and found to spring from the posterior wall of the œsophagus The sac was amputated, the wound in the œsophagus was ligated and sutured as directed and the incision was closed except for a cello-silk drain

Post-operative Treatment—Drain and stitches were removed on the tenth day During the convalescence the patient was fed through a Rehfuß tube for sixteen days X-ray examination following the operation—"there is no indication that a diverticulum of the œsophagus ever existed The lumen is slightly narrowed at the site of the former diverticulum The outline is very smooth" Patient discharged cured twenty-four days after operation

CASE IX—Male, J C L, age fifty-nine years Chief complaints are difficulty in swallowing food, solid and liquid, regurgitation of liquids and particles of food between meals He has lost much weight The first symptoms were noticed five years ago He consulted a number of physicians and various diagnoses were made He was unable to work, was practically confined to bed just previous to his admission to the hospital X-ray and œsophagoscopy examinations disclosed a well-developed diverticulum springing from the usual site Operation Preliminary gastrostomy and the combined Gaub-Jackson operation were performed at the same seance The sac was exposed and found to be densely adherent The sac was amputated at the œsophagus The œsophageal wall was reinforced

Post-operative Treatment—Patient was fed through the gastrostomy tube Stitches were removed from the neck on the tenth day There was a slight discharge from the deep tissues of the neck This persisted for five days after which the wound healed rapidly One month after the operation the gastrostomy tube was removed and the gastric fistula was permitted to heal The neck wound healed entirely eighteen days after the operation X-ray examination on the twenty-second day disclosed no evidence that an œsophageal diverticulum had ever existed Patient was discharged in good condition and has since gained thirty-five pounds in weight

CASE X—Male, A A N, age fifty-six years Chief complaints, dysphagia for solid food, slight hoarseness, loss of ten pounds in weight Present illness dates back one and a half years at which time while eating toast he had a severe choking attack, following which he developed fever, difficulty in swallowing and a severe pain in the neck Since this attack he has been unable to swallow solid food X-ray examination disclosed a small diverticulum, the sac reaching to a little above the upper border of the sternum The diverticulum is irregular in its lateral borders and presents somewhat to the right of the median line Owing to the difficulty in swallowing we were unable to get information as to the size of the opening The œsophagus below this point is

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entirely normal This case is shown in Fig 6 as a traction diverticulum Preliminary gastrostomy and the combined Gaub-Jackson operation performed at the same seance There were extensive perœsophageal adhesions The pouch was found to be adherent to the under surface of the thyroid gland The œsophagus was drawn into irregular folds around the diverticulum The sac was dissected from the dense adhesions and the irregularity of the œsophagus unfolded, the sac was fixed to the deep cervical fascia so that the fundus presented at a higher level than the opening

Post-operative Treatment—The patient's convalescence was uninterrupted The gastrostomy tube was removed three weeks after the operation The cervical wound healed by first intention X-ray examination, following the operation, by Doctor Manges "There is a small quantity of barium retained in a little pouch at the level of the first dorsal vertebra It has a wide opening and doesn't interfere with swallowing" On the patient's discharge from the hospital he was able to eat regular house diet

CASE XI—Male, J G R, age sixty-nine years Chief complaints, lodgment of food in the œsophagus, gurgling noise on deglutition, regurgitation of food Loss of considerable weight Present trouble dates back four years X-ray examination and œsophagosopic examinations by Doctor Manges and Doctor Jackson disclosed a diverticulum at the usual level, slightly larger than the average sac Preliminary gastrostomy was performed, with the combined Gaub-Jackson operation for diverticulum of the œsophagus by Doctor Clerf and Doctor Shallow Primary amputation of the sac with reinforcement of the œsophagus was done in one stage The wound was closed except for a small drain of cello-silk at the lower angle

Post-operative Treatment—Ten days after the operation the stitches and cello-silk were removed The wound healed by primary intention except for the small opening left after the drain had been removed Twenty one days after the operation the gastrostomy tube was removed and the patient was allowed to eat regular house diet Twenty-four days after operation X-ray examination disclosed no evidence of a diverticulum There is a slight narrowing of the œsophagus at the site of the operation

CASE XII—Male, A J B, age sixty-five Chief complaints are huskiness of voice, occasional regurgitation of particles of food, gurgling noise on swallowing and loss of weight X-ray and œsophagosopic examinations made by Doctor Manges and Doctor Jackson disclosed a diverticulum of the œsophagus a little below the cricoid cartilage The sac projects a little more to the right than usual Operation Combined Gaub-Jackson operation for diverticulum of the œsophagus by Doctor Jackson and Doctor Shallow The sac was removed The wound in the œsophagus was reinforced after suturing It was a one-stage operation

Post-operative Treatment—The patient was fed through a Rehfuß tube during his convalescence which lasted twenty-two days On the tenth day the stitches and cello-silk drain were removed Twenty-one days after operation X-ray examination by Doctor Manges showed that there was no evidence that a diverticulum had ever existed Patient discharged able to eat house diet

CASE XIII—R B H, age fifty-seven years Chief complaint is slight regurgitation of small particles of food after meals with gurgling noise in neck Present illness dates back four years He has not lost any weight Bronchoscopic examination by Doctor Jackson disclosed a small diverticulum springing from the usual site Operation under combined Gaub-Jackson method The sac was found to be small and the neck of it was narrow The neck of the sac was twisted and the fundus was sutured to the deep cervical fascia and the incision closed

Post-operative Treatment—No Rehfuß tube, because the sac was not amputated Liquid food was given by mouth on the second day Solid food was given on the eighth day Uneventful convalescence

CONCLUSIONS

1 The most important *functional* factor in the etiology of pulsion diverticulum is the incoordination of the cricopharyngeal pinchcock, resulting in a failure to open of the tonically closed upper end of the œsophagus

2 The use of the œsophagoscope while the surgeon is doing his work (Gaub-Jackson operation) is the operation of choice for the following reasons (a) Aspiration pneumonia is practically eliminated (b) The easy access to the sac by the use of the œsophagoscope distinctly limits the dissection and hence lessens the probability of mediastinitis (c) By transillumination and protrusion of the sac on the œsophagoscope the structure is quickly identified and its fundus found (d) The time of operation is shortened fully one-half

3 The reef stitches by slightly narrowing the œsophagus move the point of contact of the bolus of food to a higher level, so that when the food is passing over the old site of the diverticulum, it does so with a greater velocity than normal and the pulsion pressure is less This phenomenon is demonstrated by fluoroscope examination following healing

4 The reef stitches reinforce the weak triangular area over the buried stump Without such reinforcement a potential factor in recurrence of the diverticulum remains

5 The one-stage operation offers the best possibility for permanent repair, because in a two-stage operation the repair is made in much inflammatory tissue The two-stage operation is somewhat safer but far less apt to effect a permanent cure

6 Diverticula do not all spring from the same level This is exemplified by Case III, the double diverticula Diverticula may exist at birth, be present in youth and persist for years undiagnosed

7 Fistula following operation is more frequent after the two-stage than the one-stage method

8 For post-operative feeding the Rehfuß tube is passed through the nose and into the stomach and is retained for many days in order to afford rest to the œsophagus and to prevent leakage This method is superior to feeding by way of a gastrostomy In Case XIII, no gastrostomy was made and the Rehfuß tube was not used

9 Intratracheal ether insufflation is invaluable in the operation for œsophageal diverticulum We use no other method of anæsthesia in these cases at the Jefferson Hospital

10 There were no fatalities in this series of cases

11 In our series of thirteen cases there was one female This is in accordance with the accepted opinion that diverticula are much more common in males than females

12 The oldest patient was sixty-nine years of age The youngest patient to manifest symptoms of diverticula at the age of thirteen was fifty-four when he came to operation

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13 The average age of patients was between fifty-five and sixty-five years of age

NOTE—Since presenting this paper we have had two additional patients one of whom made an uneventful recovery—the other patient died on the third day of a massive collapse of both lungs

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THE ODONTOID OSSICLE OF THE SECOND CERVICAL VERTEBRA

By T WINGATE TODD, F R C S , ENG

AND

JOSEPH D'ERRICO, JR , A B

OF CLEVELAND, OHIO

FROM THE ANATOMICAL LABORATORY OF THE WESTERN RESERVE UNIVERSITY

Introduction —Frequency of separate ossicle The problem of the third condyle Size of the ossicle Relation to other anomalies Origin mamma-



FIG 1 —Separation of odontoid in W R U skeleton No 195 male White fifty years The separate ossicle itself is lost Note the double facet on the atlas

lian evidence Life history in man Evidence of fracture The single quasi-pathological anomaly Summary References

Variations in the odontoid are by no means unknown It is true that R H Hunter figures a specimen which he regards as unique,² but the subject is fully treated by Le Double⁴ Apart from the centres for the body proper of the epistropheus, there is a double centre for the odontoid base and a single

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centre for the odontoid tip According to Le Double, it was Bevan who first published a case of separation of the odontoid process This was in a woman of forty years, and the separated piece was united to the border of the foramen magnum¹

The present work was undertaken therefore, primarily to study the anomaly quantitatively

Frequency of Separate Odontoid—We have examined, in all, more than



FIG. 2.—W R U No 337 male White thirty-one years The separate ossicle is fused with the atlas

a thousand skeletons for this anomaly and have found it three times only. Actually, on the day on which the census of skeletons was taken there were 969 available. It must be understood that in dealing with large populations like this, the total number fluctuates quite considerably owing to various causes into which it is unnecessary to enter. Realizing however, that all told some 1050 skeletons of known individuals have passed under survey, we can be assured that the anomaly occurs about three times per thousand in a heterogeneous population unselected in family strains. These are quite important points, they, and others like them must be taken into consideration in stating any anatomical frequency.

The three specimens are all from male Whites, they are the following No 195, age 50, No 337, age 31, No 1021, age 81 (Figs 1, 2, 3)

Skeleton census April 6, 1925 Male, White, 629, female, White, 77, male, Negro, 209, female, Negro, 52, other races, 2, total, 969

From the foregoing it will be seen that the anomaly occurred three times in 600 male White skeletons. It is quite possible, on this frequency, that none would be found among the smaller numbers of the other groups. Conse-

quently, it is perfectly justifiable to argue that separation of the odontoid occurs once in two hundred individuals. The truth certainly lies between this figure and that given in the first paragraph.

The occurrence among male Whites alone is probably coincidence, for the other numbers are not large enough to

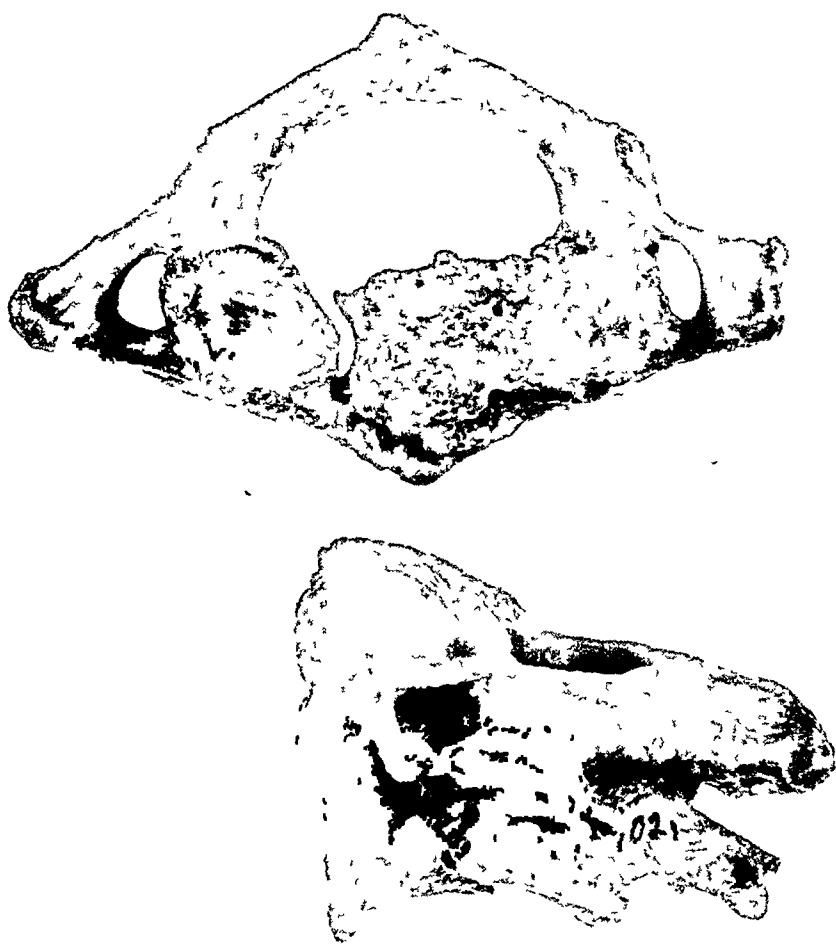


FIG 3—W R U No 1021 male White eighty-one years. Note the arthritic change present in this specimen.

justify any inference. But we have found certain anomalies which seem to cling to one sex or stock. Fusion of wrist or tarsal bones, of a congenital nature, is very much more frequent in the Negro, whereas separation of the scaphoid into two appears more characteristic of the White. It would require much further information, however, to justify any dogmatic statement.

All three present examples are alike in that it is the tip only of the peg which is missing. True, the basal part varies in height, but, as will be shown later, this is really due to the range of variation in the volume of peg formed from the apical centre. In No 195 the separated portion is lost, but in the others it is fused with the atlas. As a rule, there is a single facet on the

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atlas for articulation with the odontoid, but in No 195 the facet is double the odontoid articulating only with the upper. The senile specimen No 1021 shows that the joint between the mass of the axis and the odontoid is subject to the same quite typical arthritic changes as are characteristic of other senile joints.

We find that the odontoid varies greatly in length. In extreme cases it articulates with the cranial base (Fig 4)

The Problem of the Third Condyle—Having mentioned the third condyle, it is appropriate to note that this structure is quite composite in nature.

Its position varies slightly in relation to the margin of the foramen magnum, the variation in position being dependent upon the special character of the condyle in that particular specimen. *Four forms occur*

1. An articular process for the axis, *e g* No 668 (Fig 4)

2. An ossification of the ligamentum apicis

3. An articular process for the atlas, *e g*, No 556

4. A non-articular process for attachment of the occipito-atlantal ligament, No 246 (Fig 5)

The relative positions of the several processes which are covered by the term third condyle are well known on the accompanying radiogram (Fig 5). Here, also, incomplete ossification gives an hour-glass appearance to the form of the odontoid process. We do not support in any way the theory sometimes put forward that the third condyle represents a persistent median occipital condyle found in reptiles and birds.

For a complete and elaborate account of the third condyle Bolk's work



FIG 4a—W R U No 668 female Negro thirty-seven years. An example of a long odontoid articulating with the margin of the foramen magnum. The cranial facet is apparent at the tip of the process.

should be consulted.⁷ With this account we find ourselves in entire agreement, except that we would add form 4 mentioned above, a type not specially described by Bolk and yet, in our experience, not uncommon. In the article to which reference is made Bolk suggests that the apical centre is really an ossification of the chorda. We have not convincing evidence of this view and prefer to leave it unsettled. It is not of importance in the present research.

Size of the Ossicle—Nos. 195, 337, 1021, illustrate in negative fashion the variability in size of the ossicle, that is to say the single apical centre of ossifi-

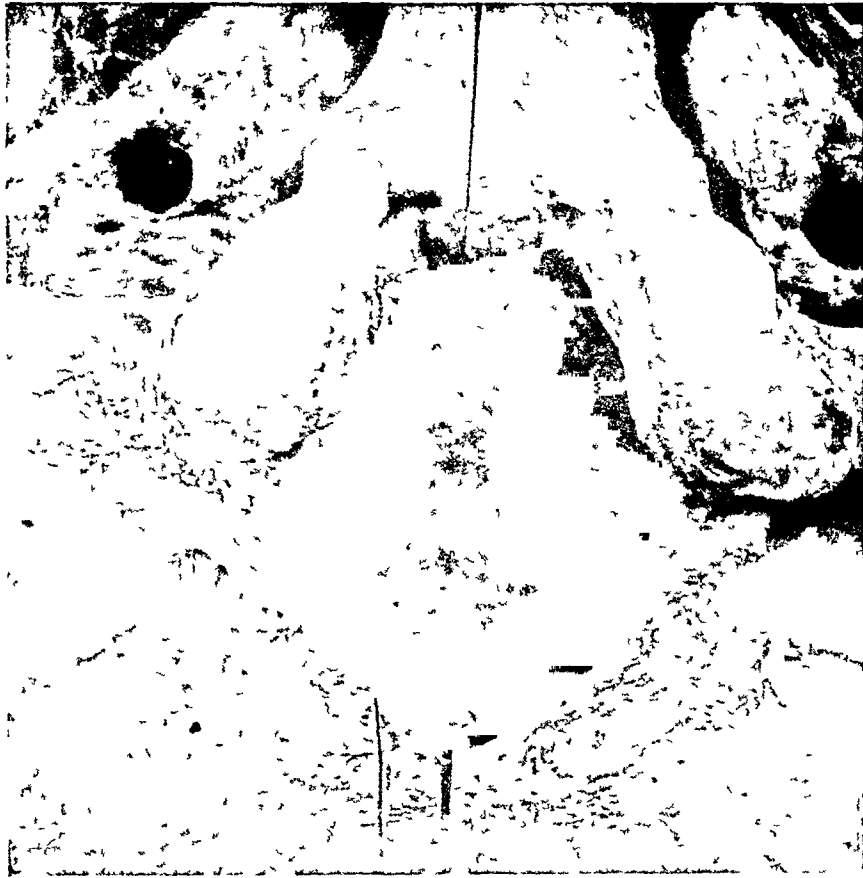


FIG 4b—W R U No 668 female Negro thirty-seven years. An example of a long odontoid articulating with the margin of the foramen magnum. Base of cranium from No 668. Note the third condyle.

cation. Direct evidence is illustrated in the young bones (Figs 9, 10, 11). No 1089 has a very small ossicle forming no more than the extreme tip of the process. No 624 has a much larger one which accounts for the entire distal half of the odontoid. Intermediate in size between these two is No 022.

Relation to Other Anomalies—No 195 shows no other marked anomalies of the skeleton. No 337 is a microcephalic individual with a cranial capacity of 870 cc. The upper jaw has failed to come forward in consequence of the lack of development in the cranium. It is not a malformation of the jaw, but a malposition. The only other skeletal anomaly in this specimen is non-union of the last piece of the sternum. The cadaver showed a greatly distended colon probably idiopathic in type. In No 1021 there is fusion of the second and third cervical vertebrae and of the seventh cervical with the first thoracic, both fusions being certainly congenital. Anomalous "separation" of the odontoid is therefore no exception to the general rule among minor anomalies.

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There is no widespread primary defect it is a perfectly local defect in development

Origin Mammalian Evidence—The various theories have been reviewed by Le Double⁴ They fall into three categories which can be briefly stated

- 1 Fracture of the apex
- 2 Hypertrophy of the ossiculum terminale with coincident atrophy of the remainder of the odontoid
- 3 Persistence of the embryonal condition or atavistic survival of the separation present in lizards and crocodiles

In spite of the arguments of various authors in favor of a traumatic cause, circumstantial evidence indicates pretty clearly a congenital origin We have therefore reviewed the life history of the human epistropheus up to the date of fusion of the odontoid elements this is the subject of the next chapter

It has been stated that permanent separation of the



FIG 5—W R U No 246 male White 10 months Relations of cranium occipito-atlantal ligament A anterior arch of atlas B and odontoid process C The odontoid is hour-glass shaped Probably no bone formation in ossicle but dense cartilage

odontoid is long continued if not constant in Monotremes and some Marsupials (Le Double, p 145) In our experience we have not found this to be true and we desire to submit the following evidence from the Museum of the Royal College of Surgeons, London in which, by the courtesy of Sir Arthur Keith, one of us had the privilege of studying the relevant material

Taking first monotremes we find the following examples

No 3965, a specimen of *ornithorhynchus anatinus* identified by us as male with all epiphyses united except those for the angle of the scapula, the crest and tuber of the os innominatum the transverse processes of epistropheus and tail and the inter-central epiphyses of the sacrum and tail In this specimen the odontoid ossicle was complete and fused with the basal part of the process which in turn was fused with the centrum

A second example of *ornithorhynchus* is No 3966 This is a very much younger specimen and of its epiphyses there were none fused merely the coracoid process beginning to unite with the body of the scapula It is probable that the epiphyses of the phalanges of fore and hind feet were united but these bones were missing from the skeleton At this stage neither there is no union of the odontoid ossicle nor is the basal part united to the centrum

In a slightly older specimen, No 3968, the ossicle is united to the basal part which however, is not yet fused to the centrum proper. In this skeleton not only was the coracoid united to the scapula, but there was fusion of the entire set of distal epiphyses of the humerus and also of the epiphysis for the head of the radius. The phalangeal epiphyses were united and those of the metacarpals and metatarsals were fusing.

Exactly when the basal part of the odontoid unites with the centrum in *Ornithorhynchus* we cannot say. But it was not yet fused in No 3969 in which the distal epiphyses of the radius, ulna, tibia and fibula were still ununited.

It is quite necessary to mention all the epiphyses named above in order to fix the date of fusion of parts of the epistropheus in the life cycle of the animal.

In *Echidna aculeata* we find a rather different time relationship. The epiphyses of the phalanges, metacarpals and metatarsals unite before the coracoid fuses with the

scapula. Of this stage in the life cycle there are three specimens. In all of them the bodies and neural arches of the vertebrae are in process of union. No 3957 is a little younger than Nos 3956 and 3954 which are of the same age. In No 3957 both odontoid ossicle and basal part are ununited, but in each of the others the former is fused but not the latter. Unfortunately the Royal College of Surgeons collection possesses no specimen giving the date of union of the basal with the centrum.

Among the Marsupials we obtained several important specimens. Three examples bear upon the ossification of the odontoid ossicle. In all

FIG 6—Fœtal vertebral column from W R U No 0 223. The two centres for the odontoid base are fused. Upper and lower depressions and the central vacuity indicate the bilateral nature.

three the third molar (not the fourth) is erupting. In No 3656, *Phascogaleus cinereus*, there is commencing union of vertebral bodies with neural arches and the odontoid ossicle is but little if any ossified. In No 3735, *Macropus billardieri*, these parts of the vertebrae are fused, there is a small ossific centre for the greater tuberosity of the humerus and that for the medial epicondyle is just beginning to ossify. In this example the apical part of the odontoid has a small bony centre. In No 3656A, *Phascogaleus cinereus*, the odontoid ossicle is fully formed but not yet united. The centres mentioned in the humerus are already further developed. Exactly when the odontoid ossicle unites we cannot say, but we have found No 3652, *Phascogaleus cinereus*, which shows complete union of the coracoid and primary centres for the os innominatum together with commencing union of the medial epicondyle of the humerus. All epiphyses of long bones in hands and feet are united and the fourth molar is erupted but not worn. In this example the odontoid ossicle is united and there is beginning fusion of the basal part with the centrum. The union of the coracoid is often preceded in Marsupials by fusion of the primary elements of the os innominatum as shown by No 3724C, *Macropus bennetti*. We can fix the time of union of the basal part of the odontoid with the centrum by No 3652 above and also by No 3861, *Thalacomys minor*, and No 3875, *Perameles nasuta*. In the former the

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basal odontoid is uniting in the latter it is still free No 3861 shows recent union of the medial humeral epicondyle together with fusion of the distal humeral epiphyses and those for the proximal ends of radius and ulna In this specimen the coracoid is still ununited It is obvious that all these epiphyses fuse just about the same time the exact order of sequence being subject to some variation In No 3875 a bandicoot of about the same age coracoid, primary acetabular elements distal humeral epicondyle and head of radius are all united and there is beginning union of the medial humeral epicondyle In No 3724C the third molar is erupted the fourth is still deep in its crypt In No 3861 the skull is missing and in No 3875 the fourth molar is already erupted and worn

We should also mention No 3630, *Phascolomys wombat* a specimen with fourth molar erupted and worn

This shows beautifully the typical marsupial ventral extension of the odontoid ossicle now fused it has an as yet ununited basal part Primary acetabular centres coracoid medial epicondyle and distal epiphysis of humerus are all united and the head of the radius is fusing There is another example of *Phascolomys wombat* with no number slightly younger than the foregoing which shows beginning fusion of basal odontoid with centrum In this the only united epiphyses are the coracoid and the third phalanges the acetabular centres are in act of fusing



FIG 7.—W R U No 211 female White eight months post-natal The central vacuity and lower depression are lost the upper is much deepened

Among other lower mammals we have found two examples of rodents the evidence from which would be useless alone but fits into its place in the present survey A very young specimen of *Hydrochoerus capybara* without number has no union of either odontoid ossicle or basal part In it the third molar is erupting, the terminal phalanges are fused the second are fusing, but as yet there is no union of epiphyses of long bones, coracoid or primary acetabular elements In the other specimen, namely No 3253A, *Coelogenys paca* the odontoid ossicle is fused and the basal part is just united the third molar is erupting the terminal phalanx only is fused and of the other epiphyses mentioned merely the distal humeral epicondyle is united but the medial epicondyle and the primary acetabular centres are fusing

Taken altogether these specimens indicate that union of the basal odontoid with the epistropheal centrum follows rapidly after fusion of the odontoid ossicle with the basal part Further these fusions occur at or near the time of union of the distal epiphyses of the humerus the coracoid and the primary acetabular centres and also close in time to the eruption of the last molar tooth Now in man these features are spread over several years in the teens say fourteen to seventeen years (Stevenson) but we shall find that in man union of the odontoid ossicle certainly occurs by twelve years and it may be

(our own observations indicate it), at six years, but fusion of the odontoid base with the centrum occurs between the fourth and sixth years. Judging by the latter fact, we must postulate some considerable modification in man of lower mammalian time relationship in union of the epiphyses and fusion of the epistropheal parts. From our own scanty observations in man we should say that there is a typical mammalian time relationship in union of the odontoid ossicle with the base, on the one hand, and between the odontoid base and the centrum on the other. But if the observations of others regarding delay and erratic date of union of the ossicle be borne out by future work, we would have to interpret it as evidence of retrogression. This question can-

not be further discussed before the observations on man have been set down.

Life History in Man—There is no doubt about the early stages in ossification or indeed about the main facts.³ A single centre for the centrum appears about the third foetal month, twin cen-

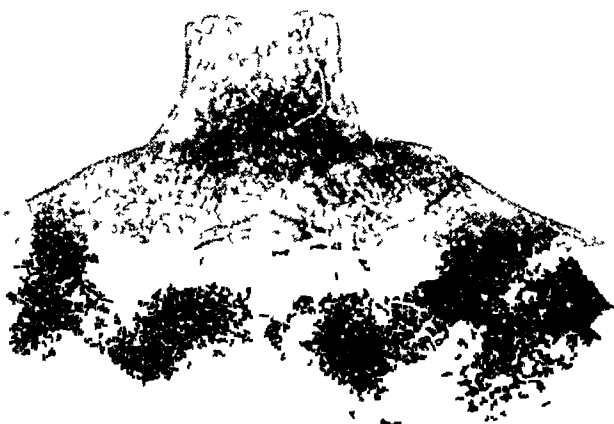


FIG 8—W R U No 095 sex ? White four or five years. The centre for the ossicle is growing. The combined basal centres would shortly have united with the centrum and lateral processes.

tres for the base of the odontoid at the fourth or fifth month. These fuse with the body between the fourth and sixth years. The apical centre appears about the second year and is united at about twelve years. This is the accepted description. We can confirm it all except the data on odontoid ossicle which has been our particular study. In Fig 6, the central vacuity and the midline depressions above and below are the last traces of the original bilateral character. The gaps between the several parts of the axis vertebra gradually narrow and ultimately fill in with resulting fusion (Figs 7, 8). The date of appearance of the centre for the ossicle is probably quite variable. In No 829, the achondroplast, it is already large at two years, much larger and better formed than in No 095 at between four and five years. In other respects No 829 is not precocious (compare Figs 8, 12). The date of union is even more variable. In No 1089 no clue to the original separation remains except the somewhat lighter texture of the bone of the ossicle. In No 624 the much larger ossicle has yet not become completely ossified and there is at best but little union. In No 0222 a third type of ossicle appears with clearly defined margins not yet united. The age of the first is five years, that of the second is six years, but the third is a

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specimen without history, it cannot be more than between four and five years. Perhaps it would be safer to state that union occurs certainly before twelve years.

In our studies of epiphyseal union we have found evidence to indicate that erratic time relationship in union is associated with a regressive change. Examples are the epiphyses at the symphysis pubis,⁶ at the sternal end of the clavicle, at the vertebral border of the

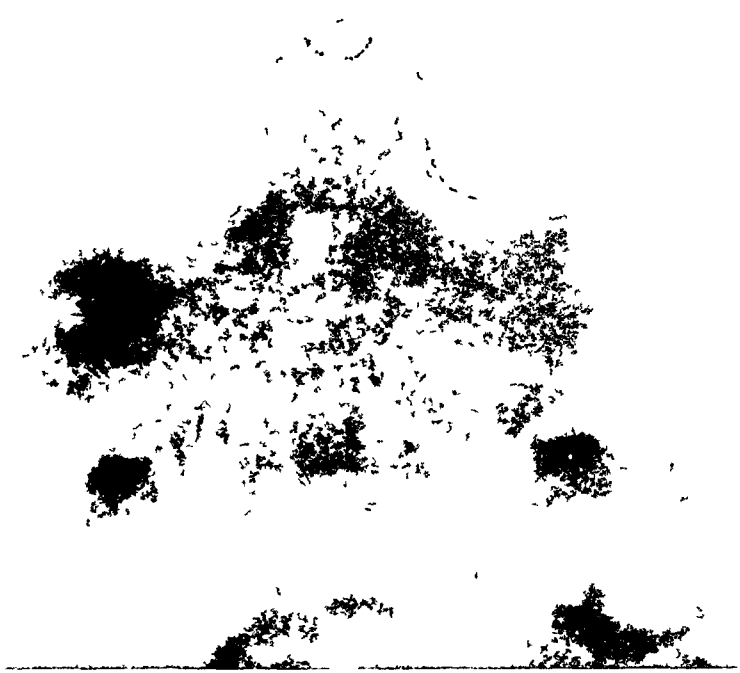


FIG 9—W R U No 1089 female Negro five years. The apical centre is fully ossified and united. It is very small and involves merely the tip of the process.

scapula, and to a less extent at the iliac crest and on the heads of the ribs.⁷ In view of the findings in Monotremes and Marsupials it is apparent that

there is distinct regression in the more typical mammalian form which is exhibited in man. The erratic time relationship in union bears out this interpretation.

Evidence of Fracture—It is unnecessary to review fully most of the features which are assumed to give evidence of fracture. The sharp irregular edges



FIG 10—W R U No 624 female Negro six years. A large ossicle not yet entirely ossified and but slightly fused with the basal part.

on No 1021 (Fig 3) are not those of fracture but of arthritis. The presence of cartilage between the ossicle and the basal part of the odontoid

is of no value as evidence either for fracture or for congenital separation. It is often held, however, that the oblique character of the hiatus indicates fracture: the ossicle is longer in front than in behind. Our studies of the

monotreme and marsupial condition show this obliquity to be characteristic of the shape of the ossicle, and although we do not happen to be able to present a human specimen presenting this particular feature, we have no hesitation in stating that we are not impressed by the emphasis often laid upon this character as evidence of fracture.

The Single Quasi-pathological Anomaly—

FIG 11—W R U No 0222 No history four or five years A large ossicle fully ossified with clear margins, not yet fused

In the consideration of anomalies a rather definite grouping makes itself apparent without, however, any very hard and fast outlines. There may be a defect of widespread nature such as the

genito-urinary anomaly which also affects the vertebral column.

At least concomitant anomalies of these two systems are quite frequently discovered. Then there is the anomaly which is frequently but not always bilateral like fusion of lunatum and triquetrum in the hand. And finally

there is the median anomaly like the one under discussion. Examples of all three groups may and often do have a pathological cause invoked for them and frequently color is given to such an interpretation because such

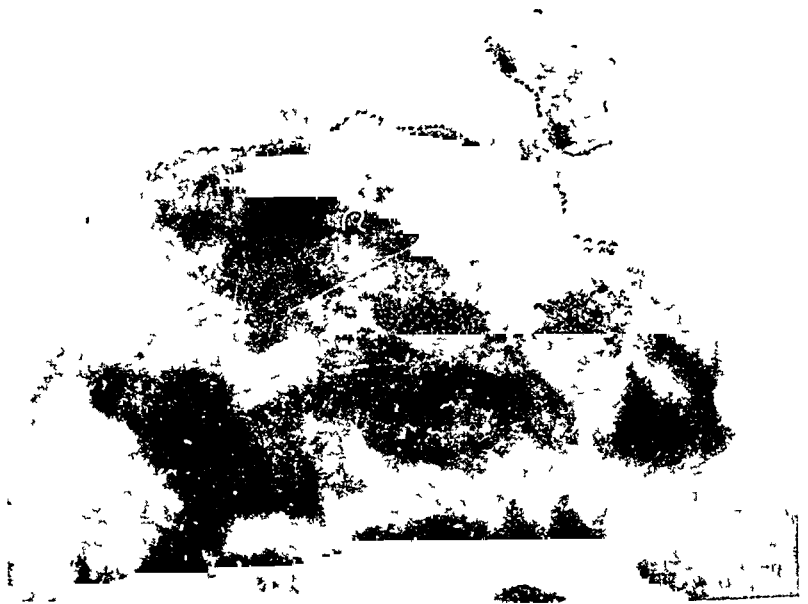


FIG 12—W R U No 8296 female White two years Achondroplasia Ossification is precocious exuberant connecting cartilage, deformity

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parts of altered vitality quite readily assume a pathological appearance. They cannot be normal in constitution but they are not pathological in origin.

In No. 1021 the arthritis present is undoubtedly associated with the great age of the individual, but it is quite possibly exaggerated by the fact of the tissue being poor stuff. Arthritis would be expected in the cervical region of any person of eighty-one years, and as there is a joint present here, it is naturally involved.

The two-year-old achondroplast No. 829 is, if anything, rather precocious than otherwise in the amount of bone formation in the ossicle but in common with other cartilaginous sites there is an exuberance of cartilage characteristic of the constitutional condition.

SUMMARY

1 So-called separation of the odontoid process is a congenital defect resulting from failure of the apical ossicle to unite with the rest of the bone and appearing with a frequency of something between once in two hundred, and three times in a thousand specimens.

2 In man as in other Eutherian mammals the ossicle is regressive in nature. This character appears in the erratic nature of the time relationship of its ossification from its first commencement to its final union. It is also apparent in the very variable size of the ossicle. It would not be fair to hold that occasional failure to unite is an evolutionary "throw back" but rather that, in consequence of its regressive nature the tissue itself is poor and liable to defect.

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THE DANGER IN THE USE OF LIPIODOL IN THE DIAGNOSIS OF OBSTRUCTIVE LESIONS OF THE SPINAL CANAL

By WILLIAM SHARPE, M D

AND

CARL A. PETERSON, M D

OF NEW YORK, N Y

FROM THE DEPARTMENT OF NEUROSURGERY, NEW YORK POLYCLINIC HOSPITAL AND POST GRADUATE MEDICAL SCHOOL

As a means of facilitating the differential diagnosis and accurate localization of obstructive lesions of the spinal canal and thus particularly of tumors of the spinal cord and meninges, compression of the spinal cord by adhesions of former meningeal exudate and of organization-residue of unabsorbed hemorrhage, together with extradural compression of the spinal canal by traumatic and tuberculous kyphoses, the injection of lipiodol into the spinal theca was first suggested by Sicaud of Paris in 1921, and strongly supported by DeMaitel. Since then and especially within the past few months, this method of diagnosis has been most favorably discussed in the literature by Sargent, Russell, Babinski, Ironside and Shapland, Laplane, Moniz, Mixer and others (Vide references). No unfavorable case reports have been found in the literature and as lipiodol is now being used more and more extensively, we feel it advisable to report our observations in three cases.

Although it is comparatively rare that a surgical lesion of the spinal cord cannot be diagnosed and accurately localized by the usual neurological examinations and especially by careful sensory tests and long before the lesion has advanced to a degree causing a more or less complete obstruction of the spinal canal, yet there are cases where even the most painstaking, thorough neurological examinations and aided by the Queckenstedt and combined cisterna magna—lumbar puncture tests, do not reveal sufficient information as to the character and accurate localization and extent of the spinal lesion to warrant an operative procedure other than an exploratory laminectomy, to avoid the use of the exploratory laminectomy with negative findings and to localize the lesion, when present, most accurately and particularly its upper and lower borders in relation to the vertebrae as early as possible. Many substances have been considered for injection into the spinal theca to be outlined about the site of the spinal block by roentgenograms, but no satisfactory material was found until Sicaud stated that lipiodol, a 40 per cent iodine solution in poppy-seed oil and opaque to the X-ray, was safe and non-irritating to the delicate membranes and tissues of the spinal cord.

In the belief that the injection of lipiodol into the spinal theca was a harmless test for the accurate localization of the upper and lower levels of spinal block in selected cases in which no definite diagnosis and localization could be made by careful neurological examinations, 1 cc. of the iodized oil preparation of Lipiodol Lafay as manufactured by Dr. L. Lafay, Pharmacien,

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Paris,^{*} and considered non-irritating to spinal structures, was injected by lumbar or cisterna magna puncture into the spinal theca of three patients—

our only three cases in which this method has been used, the results were of definite diagnostic value in all three cases, but in one case such an inflammatory reaction occurred to the arrested lipiodol at the site of the spinal block in the mid-dorsal area that the patient's symptoms and signs were aggra-



FIG. 1—V. L. One hour after injection into cisterna magna, elongated globule of lipiodol arrested at the site of spinal block at the lower level of the 7th dorsal vertebra with the patient in the sitting posture

vated to a degree necessitating its removal at a later operation of laminectomy at which were disclosed two encysted globules of lipiodol surrounded by

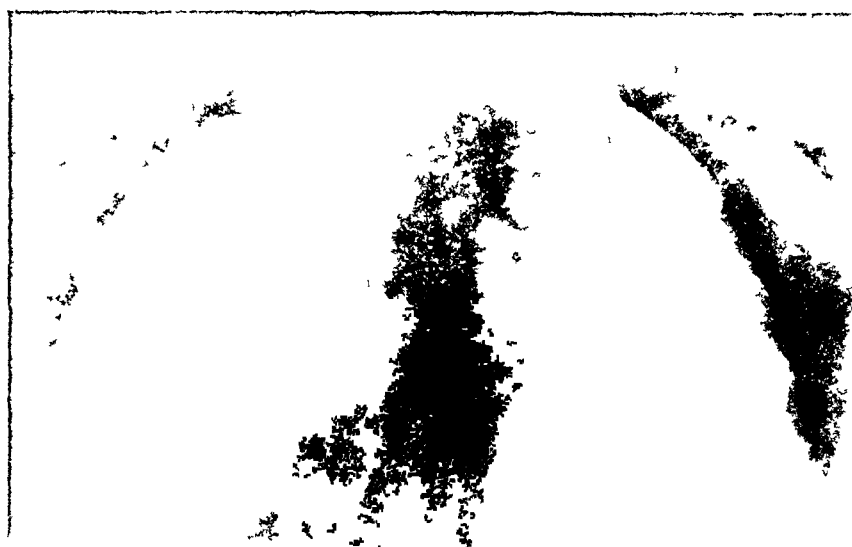


FIG. 2—V. L. Five and one-half months after injection, two small globules of lipiodol persisting at site of spinal block with marked signs indicative of an acute spinal cord compression at that segmental level

still unabsorbed—as it proved to be. Rontgenograms of all three patients now

numerous newly formed adhesions. The fact also that lipiodol in this case was temporarily, at least, non-absorbable within a period of five and one-half months, aroused our interest in ascertaining (at an interval of 15 months) whether the lipiodol injected in the other two patients was

* Chaussee d'Antin Paris. Maison M. Leczinski & Cie. 67 Rue de la Victoire, Paris. The lipiodol in ampule form was of clear transparent golden color, aseptic and chemically correct.

reveal the unabsorbed lipiodol in the spinal canal even after an interval of 15 months following the injection, and since it was found encysted and surrounded by fibrous tissue of an inflammatory reaction in the first case, as disclosed at operation in the mid-dorsal area, and changes of posture do not affect the position of the lipiodol in numerous roentgenograms in the other two cases, strongly

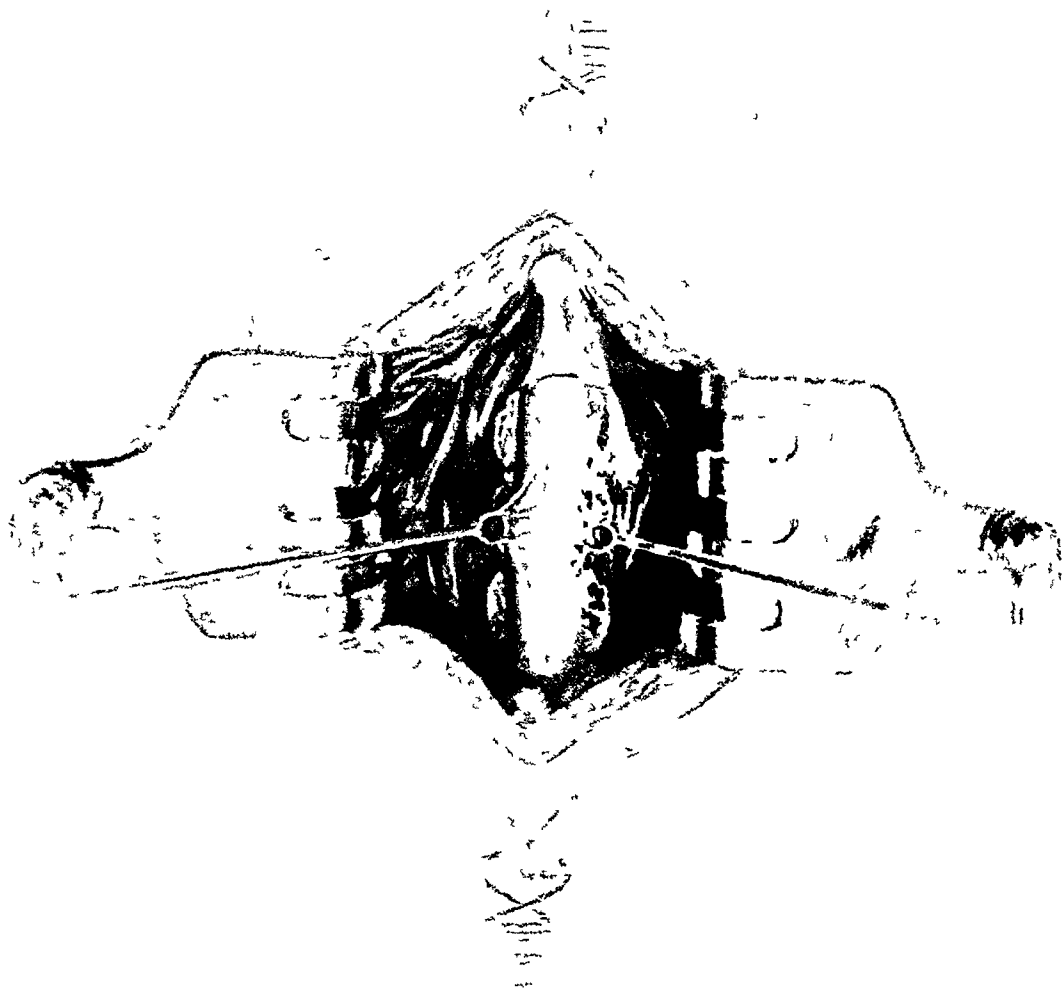


FIG 3.—\ L. Five and one-half months after injection, operative exposure of the encysted two globules of lipiodol at laminectomy disclosing the extensive inflammatory reaction to its presence and the cause for the compression myelitis

suggest that the unabsorbed lipiodol is also encysted in these two cases, however, since the lipiodol was injected in these two patients by lumbar puncture it has fortunately collected in the lowest portion of the spinal theca in the sacral cul-de-sac, so that the symptoms and signs of its presence are not marked. Our experience, therefore, is indeed discouraging—not with the idea and method, as it designates early and accurately the lesion and its extent in relation to the vertebrae—of the greatest surgical value, but with the substance lipiodol itself used for the injection and it is our opinion that lipiodol in its present

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irritating and non-absorbable form should not be used—or at least if no other satisfactory substance for injection can be found, then used only at lumbar puncture with the patient in the Trendelenburg position so that, unabsorbed, it can later sink to the less important structures neurologically of the cul-de-sac of the caudal spinal theca, and its presence produce little or no harm clinically, also used as a last resort to confirm the neurological findings in those cases where a subsequent operation is most probable, so that this irritating, non-absorbable “foreign body” can be entirely removed, or better still, in doubtful cases, the utilization of the former operative procedure of exploratory laminectomy. The use of air injected into the spinal theca by lumbar and cisterna puncture may be sufficiently satisfactory for roentgenograms in many cases until a safe non-irritating and absorbable substance has been found for such injections.

The method employed in the following three patients has been the same. 1 cm of lipiodol was introduced into



FIG 4—V L. Sixteen months after injection, round globule of lipiodol still persisting at site of operation at the level of the 8th dorsal vertebra, immovable with change of position and most probably encysted, increasing signs of spinal cord compression at this segmental level.

the spinal theca by cistern or lumbar puncture and by elevating the head and shoulders or by lowering the head and shoulders, respectively, the lipiodol gravitated quickly toward the level of the suspected spinal block. When this heavy oil was injected by cisterna puncture, the patient's head and shoulders were elevated to the sitting position, when introduced by lumbar puncture the hips were elevated with the head and shoulders lowered in the Trendelenburg position. In the presence of complete spinal block, the lipiodol was thus arrested at the upper and lower levels and early subsequent (from 1 to 24 hours after injection) X-ray examinations of the spine revealed the globules of lipiodol. The gravitation of the lipiodol in the absence of spinal block is rapid—within 5 to 7 minutes throughout the spinal canal. In the presence of partial thecal obstruction such as caused by adhesions of unabsorbed hemorrhage and meningeal exudate the lipiodol may be temporarily arrested and then be filtered slowly past the point

of partial blockage, numerous particles of lipiodol may be indicative of adhesions. Introduction of lipiodol by lumbar puncture necessitates the uncomfortable head-down position following the injection in order to maintain the oil at the lower level of spinal block during the subsequent examination, whereas the injection of lipiodol into the cisterna magna permits the comfortable sitting posture to be maintained until the clinically important upper level of the spinal block has been accurately localized by the X-ray.

The use of lipiodol on this service has been effective in demonstrating the level of spinal block, but it has been noted that the presence of this iodized oil



FIG 5—V L. Sixteen months after injection, conical suppository-shaped globule of lipiodol still persisting unabsorbed in the lowest portion of the spinal cul de sac, vesical incontinence.

preparation in the spinal theca has resulted in the aggravation of clinical symptoms and signs as demonstrated by the following case-reports.

CASE I—V L, male, white, thirty-seven years of age, laborer, was admitted to the Polyclinic Hospital in the Neurosurgical Department, May 5, 1924, on account of difficulty in walking, owing to stiff and unsteady gait. Fourteen years ago he fell a distance of 30 feet and suffered a depressed fracture of the right frontal bone and a fracture-dislocation of the

upper dorsal area of the spine, unconscious for two weeks and in the hospital for three months, the depressed frontal bone was removed and a plaster jacket was applied to the back. No residual paralysis.

Two years ago, he noticed a dragging of the right foot and three months later a similar dragging of the left foot, later, there appeared a numbness of the left lower leg, with impaired sensation to heat and cold. Early fatigue upon walking. During the past four months a definite stiffness of both legs—left more affected than right, was noticed, and this has gradually increased, but not to the degree of necessitating the use of a cane. No vesical or rectal disturbance.

He is a well-nourished man of the round-shouldered type. Heart and lungs negative. Wassermann test negative. Spastic rigidity of both legs, left leg worse than

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right Definite kyphos in the upper dorsal area of the spine—the wedge being most marked at the fourth dorsal vertebra

Neurological Examination—Deep reflexes patellar equally hyper-active with transient clonus, inexhaustible ankle clonus, double Babinski and Chaddock Triceps and biceps reflexes present and equal Skin reflexes epigastric and abdominal reflexes absent cremasterics present Romberg test—suggestive swaying No ataxia or tremor of upper extremities Pupils—equal and react normally Fundi—negative No nystagmus Speech—normal

Sensation—Bilateral hypæsthesia and hypalgesia up to eighth dorsal segment—left more affected than right Thermoanæsthesia up to left twelfth dorsal and thermohypæsthesia from left twelfth to ninth dorsal vertebræ

May 7, 1924—To ascertain the presence or not of suspected spinal block of traumatic origin, most probably in the area of the eighth dorsal segment in spite of the kyphotic wedge being greatest at the fourth dorsal vertebra, a puncture of the cisterna magna was performed, the pressure of the cerebrospinal fluid registered 14 mm, using the mercurial manometer, 1 ccm of the iodized oil preparation of lipiodol was injected and the patient placed in the sitting posture, one hour later, roentgenograms disclosed an elongated globule of lipiodol at the lower level of the seventh dorsal vertebra (*Idc* Fig 1) No complaints due to the injection

May 14, 1924—Exploratory laminectomy at upper level of the spinal block and to the site of the maximum kyphosis, removal of the laminae of the fourth fifth and sixth dorsal vertebræ disclosed a definite kinking of the cord at the site of the kyphos with fibrous thickening of the arachnoid no adhesions Patient discharged within the usual time, but during the following five and one-half months his condition became worse—spasticity increased gait became less steady and slight impairment of urinary control

October 22, 1924—Examination now indicated a more marked compressive lesion at the eighth and ninth dorsal segments Rontgenograms disclosed two globules of unabsorbed lipiodol at the lower level of the seventh dorsal vertebra and change of position did not alter their intraspinal relations (*Idc* Fig 2) For fear that the probably one year



FIG 6—A B One hour after injection at lumbar puncture and the patient placed in the Trendelenburg position, four oval globules in the lumbar thecæ and several small indistinct globules at the site of spinal block at the level of the tenth dorsal vertebra

lipiodol might be an etiologic factor in the increase in symptoms and signs of this patient, an exploratory laminectomy was again advised.

October 24, 1924.—The laminae of the seventh to the eleventh dorsal vertebrae were removed and upon incising, the dura at the site of the eighth dorsal segment were exposed many adhesive bands between the dura and the thickened arachnoid and pia. Posteriorly to the spinal cord and slightly to the right of the midline were two bulbous enlargements, upon incising their fibrous cystic walls the golden oil of lipiodol extruded in drops (*Vide* Fig. 3). An effort was made to separate all the adhesive bands. Usual closure.

Last Examination—September 18, 1925. During the past eleven months since the operation the condition of the patient has become worse—spasticity more marked, so that he requires cane and crutch, vesical incontinence. Rontgenograms now disclose one round

globule of lipiodol at the level of the eighth dorsal vertebra (*Vide* Fig. 4), also a conical globule of lipiodol in the lumbo-sacral region (*Vide* Fig. 5). Owing to the marked progression of this patient's condition, it is questionable whether another operative attempt should be made to remove all of the lipiodol—not exposed and removed at the preceding operation.

The surprise and also the disappointment experienced by us in finding globules of lipiodol in this patient over one year after injection into the spinal canal, and especially his condition becoming definitely worse following its use and localized to the site of the encysted lipiodol in the dorsal area, led us to investigate the present status of the following two patients whom we had injected sixteen months ago.

CASE II—A. B., male,

white, thirty-eight years of age, storekeeper, was admitted to the Hospital for the Crippled and Cursed on the service of Dr. Royal Whitman, March 4, 1924, on account of persistent pain in the lumbar region and extending into the right leg.

Four years ago he began to experience dull, aching pain in the lumbar region, especially after retiring. After two years the pain gradually became so severe and of a shooting character down the right leg that he was obliged to stop work. Five weeks before admission, a back brace permitted him to get about but the pain persisted. No urinary difficulties. He was well developed and nourished. Heart and lungs negative. Wassermann test negative. Definite rigidity in the dorso-lumbar area associated with tenderness.

Neurological Examination—Bilateral toe-drop with steppage gait more marked in right leg. Deep reflexes patellar hyperactive but equal, double exhaustible ankle clonus, no Babinski. Abdominal skin reflexes present—right less active than left. Sensation indefinite area of hypæsthesia in the right fourth lumbar distribution and a hyperæsthetic



FIG. 7.—A. B. Fifteen months after injection, large oval globule in lowest portion of spinal cul-de-sac with numerous small globules along the lateral portion of the lumbar theca persisting unabsorbed, vesical urgency present.

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band of two inches in width extending from above the umbilicus in the midline to the right mid-axillary line Fibrillary twitchings present in both thighs

Local examination disclosed distinct tenderness from the tenth dorsal to the first lumbar vertebræ Rontgenograms were positive—one focus of tuberculosis at the ninth and tenth vertebræ and the lower focus at the twelfth dorsal and first lumbar vertebræ—the kyphotic wedge being more marked at this lower focus

May 6, 1924—To determine if the suspected spinal block was present a lumbar puncture was first performed, using the Queckenstedt test which was positive, then a cisterna magna puncture was made to complete a combined cistern-lumbar puncture, and it, too, was positive for spinal block

May 8, 1924—In the hope that lipiodol might outline the lower level of the spinal block, 1 c cm was injected at lumbar juncture and the patient placed in the shoulders-and-head-down position, one hour after injection, rontgenograms disclosed several globules of lipiodol in the lumbar theca and two small globules arrested at the level of the tenth dorsal vertebra (*vide* Fig 6) For two days, the patient had increased pain in the lumbar area and in both legs (Unfortunately no lumbar puncture was performed to note the cell-count of an inflammatory reaction) In the hope that a spinal fusion operation might improve the condition this was performed by Dr Armitage Whitman,



FIG 8—S T Sixteen months after injection at lumbar puncture, large irregular globule of unabsorbed lipiodol at lowest portion of spinal cul-de-sac with numerous particles in the lower lumbar theca, vesical irritability and loss of sexual power

from the seventh dorsal to the third lumbar vertebræ and an excellent operative result was obtained, plaster jacket applied and finally the usual corset The condition of the patient improved gradually so that he was able to attend to his business The steppage gait became less marked and the former pain lessened in severity, there has developed, however, a vesical urgency

August 4 1925—Patellar reflexes absent No Babinski Sensation—hypæsthesia over dorsal surfaces of both feet Vesical urgency continues

August 23 1925 (fifteen months after injection of lipiodol)—Rontgenograms reveal presence of large globule of lipiodol in the cul-de-sac of the spinal theca and several smaller lateral globules up to the third lumbar vertebra (*vide* Fig 7) Permitting the patient to assume the Trendelenburg shoulders-and-head-down position for one hour does not change the position of the lipiodol—the shape of the large globule merely being altered (Undoubtedly the lipiodol has become encysted)

lipiodol might be an etiologic factor in the increase in symptoms and signs of the patient, an exploratory laminectomy was again advised.

October 24, 1924—The laminae of the seventh to the eleventh dorsal vertebrae were removed, and, upon incising, the dura at the site of the eighth dorsal segment were exposed many adhesive bands between the dura and the thickened arachnoid and pia. Posteriorly to the spinal cord and slightly to the right of the midline were two bulbous enlargements, upon incising their fibrous cystic walls, the golden oil of lipiodol extruded in drops (*Vide* Fig 3). An effort was made to separate all the adhesive bands. Usual closure.

Last Examination—September 18, 1925. During the past eleven months since the operation the condition of the patient has become worse—spasticity more marked, so that he requires cane and crutch, vesical incontinence. Rontgenograms now disclose one round



FIG 7—A B. Fifteen months after injection, large oval globule in lowest portion of spinal cul de sac with numerous small globules along the lateral portion of the lumbar theca persisting unabsorbed, vesical urgency present.

globule of lipiodol at the level of the eighth dorsal vertebra (*Vide* Fig 4), also a conical globule of lipiodol in the lumbo-sacral region (*Vide* Fig 5). Owing to the marked progression of this patient's condition, it is questionable whether another operative attempt should be made to remove all of the lipiodol—not exposed and removed at the preceding operation.

The surprise and also the disappointment experienced by us in finding globules of lipiodol in this patient over one year after injection into the spinal canal, and especially his condition becoming definitely worse following its use and localized to the site of the encysted lipiodol in the dorsal area led us to investigate the present status of the following two patients whom we had injected sixteen months ago.

CASE II—A B, male, white, thirty-eight years of age, storekeeper, was admitted to the Hospital for the Ruptured and Crippled on the service of Dr. Royal Whitman, March 4, 1924, on account of persistent pain in the lumbar region and extending into the right leg.

Four years ago he began to experience dull, aching pain in the lumbar region, especially after retiring. After two years the pain gradually became so severe and of a shooting character down the right leg that he was obliged to stop work. Five weeks before admission, a back brace permitted him to get about, but the pain persisted. No urinary difficulties. He was well developed and nourished. Heart and lungs negative. Wassermann test negative. Definite rigidity in the dorso-lumbar area associated with tenderness.

Neurological Examination—Bilateral toe-drop with steppage gait more marked in right leg. Deep reflexes patellar hyperactive but equal, double exhaustible ankle clonus, no Babinski. Abdominal skin reflexes present—right less active than left. Sensation indefinite area of hypæsthesia in the right fourth lumbar distribution and a hyperæsthetic

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band of two inches in width extending from above the umbilicus in the midline to the right mid-axillary line. Fibrillary twitchings present in both thighs.

Local examination disclosed distinct tenderness from the tenth dorsal to the first lumbar vertebræ. Rontgenograms were positive—one focus of tuberculosis at the ninth and tenth vertebræ and the lower focus at the twelfth dorsal and first lumbar vertebræ—the kyphotic wedge being more marked at this lower focus.

May 6, 1924 —To determine if the suspected spinal block was present, a lumbar puncture was first performed, using the Queckenstedt test, which was positive, then a cisterna magna puncture was made to complete a combined cistern-lumbar puncture, and it, too, was positive for spinal block.

May 8, 1924 —In the hope that lipiodol might outline the lower level of the spinal block, 1 c cm was injected at lumbar juncture and the patient placed in the shoulders-and-head-down position, one hour after injection, rontgenograms disclosed several globules of lipiodol in the lumbar theca and two small globules arrested at the level of the tenth dorsal vertebra (*Vide* Fig 6). For two days, the patient had increased pain in the lumbar area and in both legs (Unfortunately, no lumbar puncture was performed to note the cell-count of an inflammatory reaction). In the hope that a spinal fusion operation might improve the condition, this was performed by Dr Armitage Whitman, from the seventh dorsal to the third lumbar vertebræ, and an excellent operative result was obtained, plaster jacket applied and finally the usual corset. The condition of the patient improved gradually, so that he was able to attend to his business. The steppage gait became less marked, and the former pain lessened in severity, there has developed, however, a vesical urgency.



FIG 8—S T. Sixteen months after injection at lumbar puncture, large irregular globule of unabsorbed lipiodol at lowest portion of spinal cul-de-sac with numerous particles in the lower lumbar theca, vesical irritability and loss of sexual power.

August 4, 1925 —Patellar reflexes absent. No Babinski. Sensation—hypæsthesia over dorsal surfaces of both feet. Vesical urgency continues.

August 23, 1925 (fifteen months after injection of lipiodol) —Rontgenograms reveal presence of large globule of lipiodol in the cul-de-sac of the spinal theca and several smaller lateral globules up to the third lumbar vertebra (*Vide* Fig 7). Permitting the patient to assume the Trendelenburg shoulders-and-head-down position for one hour does not change the position of the lipiodol—the shape of the large globule merely being altered (Undoubtedly, the lipiodol has become encysted).

CASE III—S T, male, white, thirty-eight years of age, needle-worker, was admitted to the Hospital for the Ruptured and Crippled on the service of Dr Roval Whitman, April 20, 1924, on account of persistent pain in thigh and stump of right leg amputated just below the knee

For ten years he has had pain in the right lower leg with ulceration, and finally, in 1923, the right leg was amputated just below the knee. Shooting pains in right thigh to stump and slight ulceration of stump caused him to apply to the hospital for admission, slight vesical urgency

He is well developed and nourished. Heart and lungs negative. No evidence of vascular disease. Wassermann test negative. Stump of right leg slightly reddened and tender

Neurological Examination—Deep reflexes: patellar present and equal, left Achilles reflex active, no Babinski. Biceps and triceps reflexes present and equal. Sensation: definite anæsthesia and analgesia over perineum and in the distribution of the right first, second, third, fourth, and fifth sacral segments

May 8, 1924—Suspecting a lesion of the cauda equina and in the hope that lipiodol might aid in its localization, one ccm was injected by lumbar puncture into the spinal theca and the patient placed in the Trendelenburg shoulders-and-head-down position for twenty minutes, roentgenograms now disclosed the globules of lipiodol at the level of the seventh cervical vertebra, and, upon the upright posture being resumed, then the lipiodol quickly collected in the lowest portion of the thecal cul-de-sac with no arrest in the area of the cauda equina. For two days the patient complained of severe pain in the lower lumbar area and down the left leg requiring the use of morphine. (It would have been interesting to have performed a lumbar puncture at this time to note any increased cell count, etc.) During the past sixteen months, the general condition of the patient has improved, but the shooting pains have extended to the left thigh and left lower leg, with an increased vesical irritability and loss of sexual vigor

September 23, 1925 (sixteen months after injection of lipiodol)—Rontgenograms (*Vide* Fig 8) reveal the unabsorbed lipiodol in the lowest portion of the thecal cul-de-sac as located immediately following the injection, and upon the patient being placed in the shoulders-and-head-down position for one hour, yet no alteration in its position results, merely a change in its form due to gravitation—the lipiodol undoubtedly being encysted with the lower portion now more swollen than the upper part

CONCLUSIONS

It is realized by us that three cases are indeed a small number from which any definite conclusions may be drawn, and yet since the lipiodol used has been tested and has been reported aseptic and chemically pure, the complications observed concerning the inflammatory reaction to its presence in the spinal theca even necessitating in one case an attempt to remove it by a laminectomy makes it advisable to express at least a word of caution regarding its use and especially as an early, routine and confirmatory method of diagnosis. The fact that it is apparently non-absorbable is in itself a potential danger

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THE RADICAL BREAST OPERATION WITH THE ENDOTHERM KNIFE (ACUSECTOR) AND WITHOUT LIGATURES

By HOWARD A. KELLY, M D

AND

GRANT E. WARD, M D

OF BALTIMORE, MD

FROM THE HOWARD A. KELLY HOSPITAL

IN DEVELOPING any new radical operation for the malignant breast, it is not likely that the extirpative Halsted-Willy Meyer procedure will be notably

improved. Changes in technique, however, are always possible, improving important details, especially welcome are those which tend to shorten the duration and to lessen the likelihood of infection, as well as the chance of disseminating the tumor cells. We believe we have such an improvement in the radical breast operation in the new endothermic methods.

We have recently done a number of radical breast operations, as well as excised various suspicious nodules, using electrothermic methods alone, securing primary union in all but one, a simple amputation in a fat patient. In the radical procedures the axillary and infra-clavicular tissues were also completely dissected out with the endotherm knife, in some the large pectoral

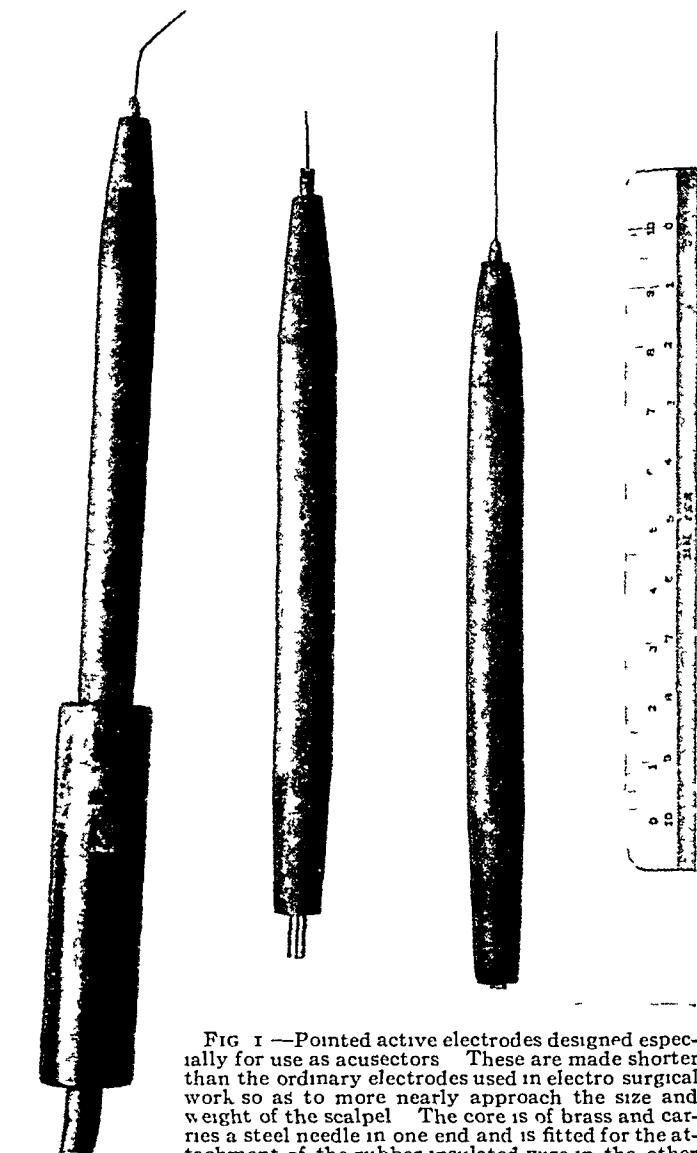


FIG. 1.—Pointed active electrodes designed especially for use as acusectors. These are made shorter than the ordinary electrodes used in electro-surgical work so as to more nearly approach the size and weight of the scalpel. The core is of brass and carries a steel needle in one end and is fitted for the attachment of the rubber insulated wire in the other

end. Any size or shape of needle may be used. The body of the electrode is made of hard rubber or fibre.

muscle was denuded of its investing fascia and was left skeletonized.

Underlying Electrical Principles—As the electrical principles involved in

BREAST OPERATION WITH THE ENDOTHERM KNIFE

the endotherm "knife," which we prefer to call an acusector—cutting with a needle—have been fully described by Dr Geo A Wyeth its originator (*Amer Jour Electrotherapeutics and Rad* May, 1924 pp 186-187), and later by Ward (*Jour A M A*, Feb 28, 1925, vol lxxxiv No 9), we here refer but briefly to the principles involved. The "cutting" which is effected by a high frequency undamped current, is not a true cutting but a molecular disintegration of the tissues at the point of contact, an arc being formed between the tissue and the tip of the needle which is held just over the tissues. This is an essential feature, for without the arc there is no "cutting" or division, but in its place a small area of coagulation around the needle. We have thus an entirely new element in our technic to be acquired skillfully only with practice, as the habitual impulse to make pressure (as in using a scalpel) is for a time almost irresistible. The acusector imparts a new sense, that of feeling the tissue separating or yielding apparently spontaneously before the point of the needle.

Technic—The type of incision is immaterial—whether from breast to axilla or *vice versa*. The skin wound is planned and made as the needle follows the separation of the tissues. The skin and fat open with remarkably little hemorrhage from the lesser cutaneous vessels while skin flaps are lifted easily from the chest wall to any desired extent with great facility. Larger vessels which persist in oozing are caught with pointed Halsted clamps and are left to be dealt with later. If the larger pectoral muscle is left as the overlying structures are lifted it is found to be curiously bared of its fibrous investment by the current, and obviating any special fascial dissections.

The axilla is dissected clean with the acusector without injury to the larger vessels and nerves which should be protected by a wooden or hard rubber spatula pressing them to one side, in order to insulate them completely from the current for there is here a danger which must be sedulously avoided, namely that of a twitching muscle throwing the point of the needle against

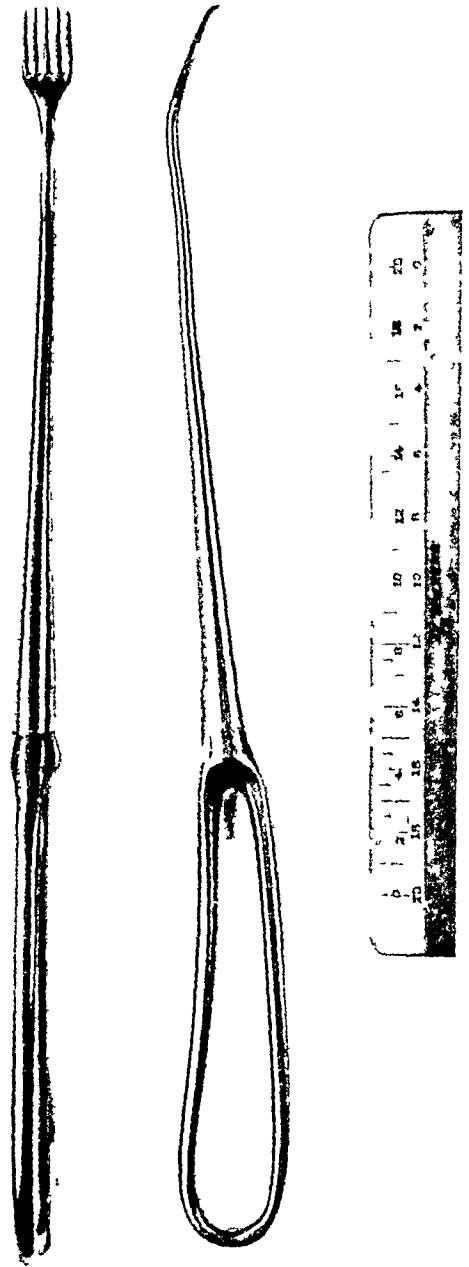


FIG 2—Kelley's comb used in dissecting the axilla

the axillary artery or vein. Should this occur, a hole would appear instantly, with a hemorrhage proportionate to its size. To avoid this risk the type and

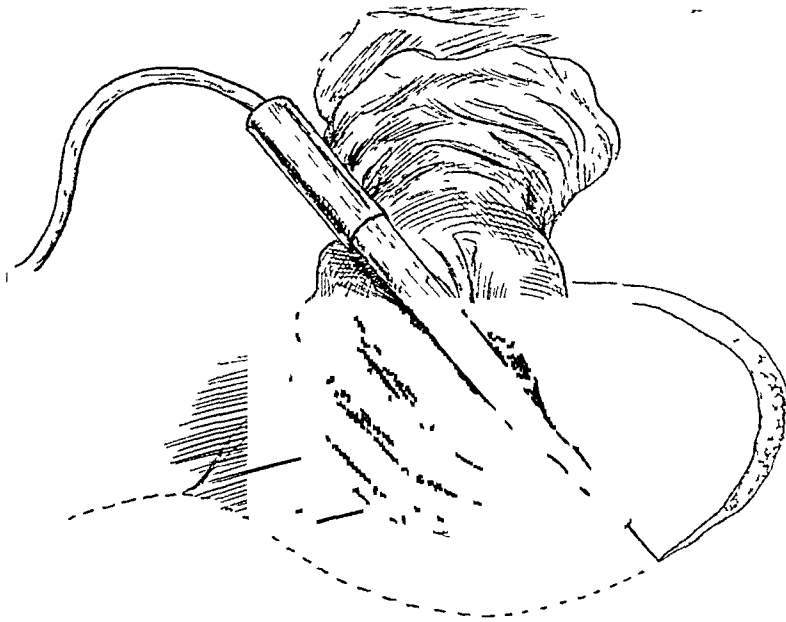


FIG 3 —Making the skin incision with the acusetter. Notice how the tissues part at the lightest touch of the needle.

strength of the cutting current can be easily altered in one or both of two ways: first, by reducing the voltage passing through the filament of the DeForest tubes; the temperature is lowered and less current passes through the grid circuit, which carries the cutting current; second, the grid circuit can be

thrown partially out of "tune" with the induction coil transformer circuit by varying the tuning coil as indicated by the Neon light. In this manner an exceedingly fine spark is obtained for most delicate dissections. A most valuable aid in skeletonizing this area is found in the axillary comb (H. A. Kelly, *ANNALS OF SURGERY*, July, 1906, also see photo), which is used with far greater safety and rapidity than any other instrument, quickly baring the vessels and isolating them from the large artery and vein and separating the nerves. These vessels are clamped and divided (not ligated) to be treated later.

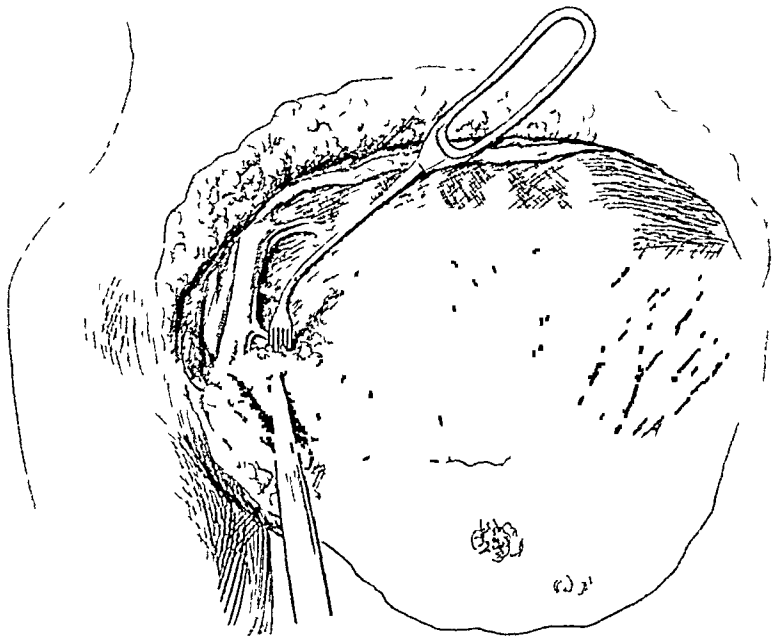


FIG 4 —The Kelley comb skeletonizing the branches of the axillary vessels.

These vessels are clamped and divided (not ligated) to be treated later.

BREAST OPERATION WITH THE ENDOTHERM KNIFE

Hæmostasis—After removing the breast and the axillary glands *en masse* with or without the pectoral muscles, a complete hæmostasis is secured by a rapid new method described by Ward (*Medical Journal and Record*, April 15, 1925). The clamps left on the bleeding vessels are lifted one by one in the operator's left hand and held at right angles to the patient's body while the right hand applies the active needle electrode switched over to the coagulating (damped high frequency) current momentarily to each clamp. The current flows down and off the point, striking the vessel held in its jaws. The measure of the duration and amount of current applied is a slight hair-like ring of coagulation at the point of the clamp. With this secured the current is shut off by lifting the needle and the clamp removed. The time consumed is about one-half or one-third that required to place a ligature. One avoids in this way the introduction of the foreign ligature material, which is always objectionable when avoidable. There is also the economic saving of ligatures, and of the time spent in their preparation. By observing these principles a complete breast operation has

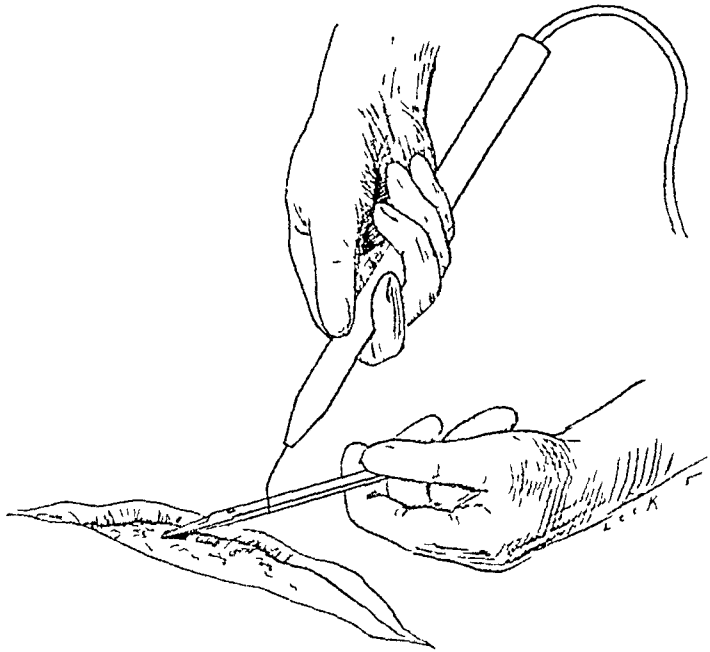


FIG 5 —Illustrates hæmostasis without suture by running the coagulating current down the clamp

been done without using a single ligature of catgut or silk. The wound in the case being described was closed with the usual drain when the incision healed *per primam*. Considerable serum collected beneath the skin flap due to insufficient pressure of the dressing, but this ceased in a few days without infection or secondary hemorrhage.

Another precious use of the coagulation current is to destroy any densely adherent gland *in loco* by plunging the needle into it at one or more points, thoroughly cooking the whole interior (H. A. Kelly). Infected tissues, difficult to remove by dissection, can also be treated in this way, both sterilizing them and destroying the disease. This is a field of great promise which, however, requires experience and must be tried out carefully.

Warnings—The current used in the acusector causes muscular contractions when applied to nerves or muscles. By reducing the voltage as recommended such contractions are so far reduced as to be negligible. The

coagulating (damped) current necessarily causes marked contractions when used near a muscle, which can easily injure a vessel or nerve by a sudden contact, *verbum sapienti satis est*



FIG 6 —Photo of healed incision after radical breast operation without a ligature using the technic of coagulating blood-vessels described in text

depth of tissue destruction on each side of the acusector is one-tenth millimetre. It is easily possible that primary union is promoted because of sterilization of the skin edges

Advantages — 1

Lymphatics, capillaries and small blood-vessels are sealed, limiting the number of clamps applied. There is reasonable hope that this closure of the lymphatics will lessen the liability to local recurrences

2 Few or no ligatures used. The elimination of ligatures helps keep hands out of the wound. The operation can thus be done with hands at a distance, lessening the chance of infection

3 Primary union is the rule, the actual

4 The reduction of ligature material is no mean economical saving

OBSERVATIONS ON THE TREATMENT OF GALL-STONES*

BY KENELM H. DIGBY, F.R.C.S., ENG

OF HONG KONG, CHINA

HO TUNG PROFESSOR OF CLINICAL SURGERY AND PROFESSOR OF SURGERY IN THE UNIVERSITY OF HONG KONG

Few operations give greater satisfaction to patient and to surgeon alike than does a successful operation for gall-stones. And, one may add, few experiences are more distressing than failure of the operation to procure relief.

A small calculus overlooked leading to a recurrence of all the symptoms, a mucous fistula due to a timid cholecystostomy, obstructive jaundice or total biliary fistula from damage to or ulceration of the ducts †. These are the dreads of the surgeon, and each demands a further and maybe more difficult and dangerous operation for its relief. I do not suppose any surgeon who has had to deal with a large number of these cases has been so fortunate as to escape all such disappointments.

This paper advocates certain steps designed to obviate the risks of such mishaps. Some of these measures are unconventional, but they may have been slowly developed as the logical result of experience.

The first plea is for prompt and early operation. The presence of gall-stones is not usually regarded as a condition demanding *immediate* operation. Instead if an attack of biliary colic is actually in progress many surgeons seem to prefer waiting until the attack has subsided. Yet this hesitation involves certain definite risks.

1. During the attack a stone may pass from the cystic duct into the common bile duct and float about in the common bile and common hepatic ducts. Attacks of obstructive jaundice are liable to occur and a biliary type of cirrhosis of the liver sets in. The case now assumes a graver aspect both from the point of view of immediate operative mortality and of subsequent moribidity. Cases with stones confined to the gall-bladder treated by routine measures have a 2 per cent surgical mortality.

When the stones have passed on into the common bile and the common hepatic ducts the operative mortality may reach as high as 10 per cent.

2. A stone may become impacted at the ampulla in a patient (where the anatomical arrangements permit) in such a way as to enable the gall-

* The substance of this paper was communicated to the Surgical Section of the Joint Conference of the Hong Kong Branch of the British Medical Association and the China Medical Missionary Association in January, 1925.

† Balfour and Ross¹ reviewed 166 cases of post-operative biliary fistula seen at the Mayo Clinic between January 1, 1910, and December 31, 1919.

Eisendrath² collected and reviewed fifty-one cases of operative injury of the common and hepatic bile ducts.

Zabala and Bengolea³ have drawn attention to the frequent injury to the ducts in cholecystectomy operations as also has Walton⁴.

bladder to squirt bile into the pancreatic duct. A true biliary colic may then have passed insidiously into the very serious condition of acute hemorrhagic pancreatitis, which has the terribly high death-rate of 75 per cent and upwards.

The following case illustrates this point. Mrs K, aged thirty-eight. Between July and October, patient had had three attacks of colicky pain in the right hypochondrium unaccompanied by jaundice. On Sunday, October 15, at 11 P.M., a fourth attack of pain began. On admission to hospital on

Monday morning the temperature was 99.4 and the pulse 84. There was tenderness beneath the right costal margin and a sharp pain at the end of a deep inspiration. The case was regarded as a typical biliary colic and it was decided to wait until the attack had subsided before operation. Next morning (Tuesday) the temperature was 101 and the pulse 106, slight jaundice was present and there was bile in the urine. Immediate laparotomy then displayed extensive fat necrosis, bile-stained peritoneal fluid and great tension in the gall-bladder. As

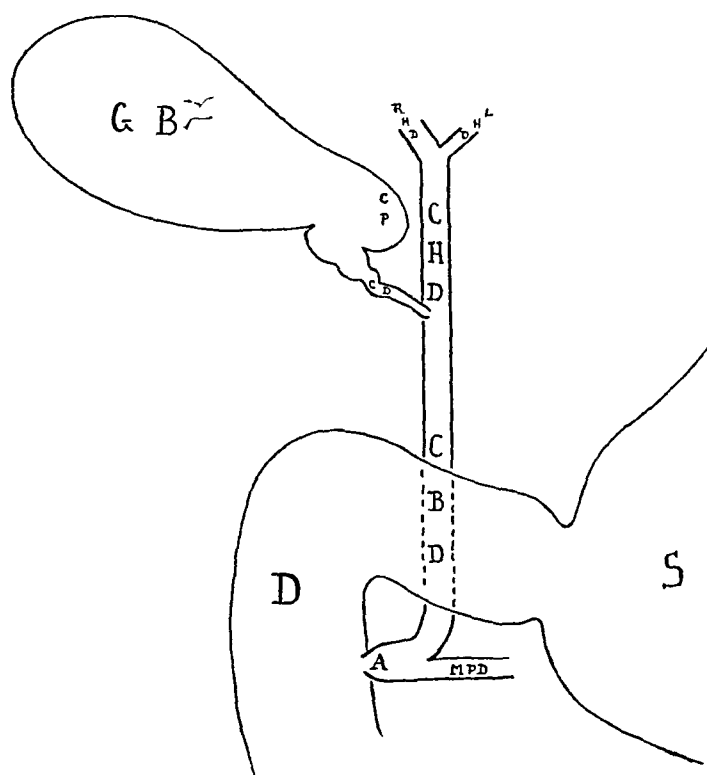


FIG. 1.—Diagram of biliary tract (showing the nomenclature used in this paper). GB Gall-bladder RHD Right hepatic duct LHD Left hepatic duct CHD Common hepatic duct CBD Common bile duct MPD Main pancreatic duct A Ampulla of Vater CP Cystic pouch

it happened, this patient did recover, but her life had been jeopardized by the delay.

3 Obstruction of the cystic duct may lead to such distention of the infected gall-bladder as to cause perforation or gangrene of the gall-bladder. These again are very serious conditions which would rarely be met with if prompt operation for biliary colic became the general rule.

The following rule may therefore be enunciated:

Whenever a reasonably probable diagnosis of gall-stones can be made, operation should be undertaken at once.

As with every other rule certain exceptions and reservations must be made. In the absence of an acute attack the convenience of the surgeon and the patient can be consulted and the case can wait for a few days. Again, if jaundice is deep or has been present for long, the operation should be

postponed forty-eight hours to permit injections of calcium chloride to be given and other suitable preparation of the patient to be carried out

The second plea is for *the free-est possible exposure of the biliary tract*. Perthes' incision⁷ probably gives the widest approach with least damage to the essential structures of the abdominal wall, namely nerves and aponeuroses, and the following slight modification has been practiced with considerable satisfaction

A vertical paramedian incision 2 cm to the right of the middle line is made from the costal margin to just below the level of the umbilicus. The anterior layer of the rectus sheath is divided in the same line and the rectus muscle retracted lateralwards. The posterior rectus sheath is divided close to the linea alba, for if divided further out it is hard to sew up, the stitches easily tearing out. The tendinous inscription obliquely crossing the rectus muscle from near the umbilicus is identified and the skin, muscle and both layers of the sheath divided along or slightly above the line of the inscription. An angled incision is thus made into the abdomen and the more the patient strains the wider gapes the opening, so that no retractors are needed for the abdominal wall. No nerves are cut. The spine can be angled in the lower part of the thoracic region, so bringing the bile ducts forward without tightening the edges of the parietal wound as occurs in a simple vertical incision. Moreover, the posterior part of the rectus sheath can afterwards be securely sutured which is not always the case with the vertical mid-rectus incision.

The third contention put forward in this paper is the most unorthodox for here it is asserted that the most important routine step at operation for gall-stones or for acute hemorrhagic pancreatitis is *choledochotomy*. A longitudinal incision should be made into the bile duct just above the duodenum. And this is urged on two grounds, namely

(a) That it is impossible to detect all stones in the main ducts by mere palpation, and

(b) That it enables a T-shaped metal tube to be inserted as a guide, thus avoiding the risk of serious stricture-producing injuries during the following cholecystectomy.

With regard to (a) it may be said that even if there has never been a trace of jaundice, yet a small pebble may have passed along the cystic duct and be floating in the common hepatic or common bile ducts. If jaundice has supervened upon any attack of colic, the possibility of stones in the main ducts becomes a probability. External palpation certainly detects a great many stones in this situation, and if a stone be found it should, if possible, be manipulated into position and made use of in opening the duct. But we cannot exclude the presence of stones with absolute certainty unless the duct be opened.

The gall-bladder and liver are gently raised by means of a broad, flat liver retractor, the first part of the duodenum is pulled downwards and held by a sero-muscular stay suture. The foramen epiploicum is found the index-finger is introduced and the duct palpated between finger and thumb as far

as possible. If no stone is found the foramen epiploicum and the space to the right of the free edge of the gastro-hepatic or lesser omentum is packed lightly with gauze. This saves the right posterior subphrenic pouch from contamination with any bile which may escape. The peritoneum is then incised vertically in front of the free edge of the lesser omentum and the bile duct recognized. Its adventitious sheath is divided vertically and each edge is

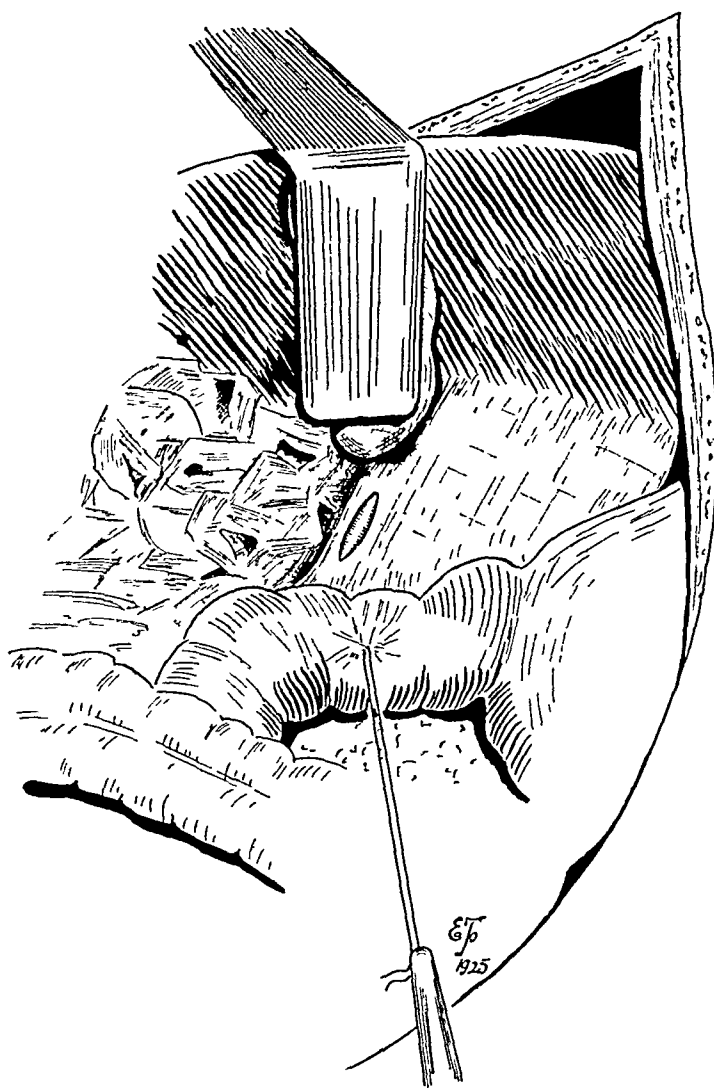


FIG. 2 —Exposure of common bile duct

seized with a pair of pressure forceps which serve to steady the duct when its wall is incised as the next step. A half inch incision is made (Fig 2).

It is remarkable how free this part of the duct system often is from adhesions. I have operated on cases where the gall-bladder and cystic duct were buried in adhesions, where the bile duct had contained calculi for months, and even where the gall-bladder was shrunken and empty, having discharged all its stones into the main ducts, and yet the peritoneum covering this part of the common bile duct was normal and free from adhesions.

Very rarely an abnormally long cystic

duct may be opened in mistake for the common bile duct, but no harm will be done thereby. If the first part of the duodenum is pulled downwards and the common bile duct be opened close to the upper border, one is nearly always below the entry of the cystic duct. At this point, too, the portal vein is well over to the left side, but if there is any doubt about the duct, a hypodermic needle should be inserted and fluid withdrawn with a syringe to establish identity. The common bile duct just at the upper border of the duodenum is largely free from any mass of sympathetic nerves (such as lie about the common hepatic duct), so that no shock is produced by manipulation at this

THE TREATMENT OF GALL-STONES

level in contrast with the marked shock which may follow interference higher up

Even with the duct opened great care must be exercised if no stones are to be overlooked. If the duct is dilated much beyond its usual quarter inch diameter, the presence of stones is certain. If this dilation is sufficient to permit of it, a slender index-finger may be introduced and should be passed upwards as far as possible, at least as far as the bifurcation into right and left hepatic ducts and should be passed downwards to and as far as possible into the funnel-shaped narrowing at the ampulla. By this means, stones will be readily detected and can be removed with a scoop.

If escape of bile be too free a pair of non-serrated forceps (*e g*, the so-called silkworm forceps, Guy's pattern, Down Bros, No 744) may be used to compress lightly the duct above. These forceps may sometimes be employed successfully in a manoeuvre to extract small stones from the hepatic duct. The duct is compressed for a few minutes till swollen with bile, the forceps are then released and small pebbles may be swept out with the ensuing rush of bile.

The ducts should also be explored upwards and downwards with a probe, which must also be passed through the sphincter at the ampulla well into the duodenum. The probe should be easily bendable by hand and should have an acorn head (with gently sloping shoulders to facilitate withdrawal through the sphincter). Two probes should be used, the acorn heads, respectively, of $\frac{3}{16}$ inch and $\frac{1}{8}$ inch diameter. Some patterns of Babcock's varicose vein probe answer the purpose well.

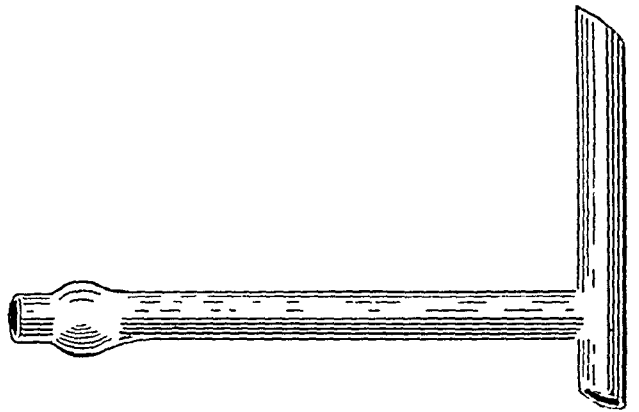


FIG 3 —The type of metal T-tube employed

Finally when the bile and hepatic ducts are clear of stones a T-shaped metal guide of appropriate size is introduced and the gall-bladder may now be safely dealt with. The exact construction of the T-guide is still in the experimental stage. The form I have used (Fig 3) consists of a stem or handle three inches long and a cross-piece reaching half an inch beyond one way and one and a half inches the other. The long end is pushed upwards into the common hepatic duct and is bevelled on the side remote from the stem to facilitate introduction. The short end is bevelled on the same side as the stem and passes down into the bile duct and serves the purpose of making the guide self-retaining after introduction. The cross-piece being a tube, enables the passage of bile the usual way without undue leakage. This guide is made in various sizes, ranging by $\frac{1}{16}$ of an inch from $\frac{2}{16}$ to $\frac{3}{4}$ of an inch in diameter and one should be chosen for use which nearly fills the duct in each particular case.

The common bile and common hepatic ducts are now clearly defined to

touch and perhaps even to sight, and there should be little risk of injury during removal of gall-bladder and cystic duct (Fig 4) Even if such an accident happened the injury would of necessity be slight, readily recognized and easily and quickly repaired Hence the gall-bladder may safely be removed from the fundus towards the ducts, and moderate traction may be employed with impunity

At the conclusion of the operation the T-guide is withdrawn, the peritoneum and loose adventitia lightly closed with a plain catgut suture, and the end of a drainage tube placed over the suture line

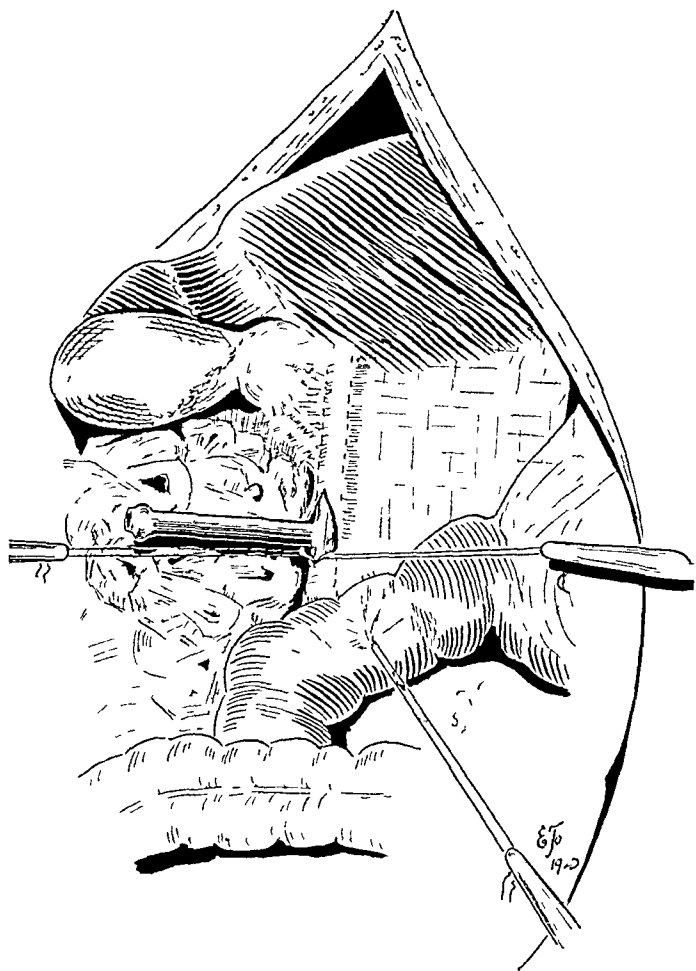


FIG 4 — The metal T-tube in position filling, fixing and clearly defining the common hepatic and common bile ducts

The last point to be touched upon here is the question whether the gall-bladder should be removed or merely drained It is not necessary to recapitulate all the arguments that have been brought forward in the discussion of cholecystostomy *versus* cholecystectomy Suffice it to say that it is the usual but not unanimous opinion of surgeons that removal of the gall-bladder is desirable for the following reasons

(1) It is already diseased and a diseased gall-bladder may produce another crop of stones Eisendrath and Dunlavy⁶

have shown that even the stump of the cystic duct may dilate and generate fresh stones

(2) It may be the early seat of carcinoma already or it may become carcinomatous Leitch's recent work⁷ in producing carcinoma experimentally in gall-bladders of guinea pigs by inserting calculi therein, supports the early clinico-pathological evidence on this point

(3) Convalescence is longer and recovery less certain when the gall-bladder is not removed but merely drained Bland-Sutton⁸ quotes Tanner, who in 1914 analyzed 117 consecutive cases of gall-stones in Guy's Hospital, and found patients submitted to cholecystectomy were only half as long in

hospital as those submitted to cholecystostomy. Balfour and Ross¹ analyzing 166 cases of post-operative fistula, found that in only 10 per cent had the gall-bladder been removed.

The reasons for this are that with cholecystostomy a small stone may be overlooked in the cystic duct overlapped by the cystic pouch of the gall-bladder, or an ulcer in the cystic duct may produce stenosis leading to a mucous fistula or recurrent cholecystitis may lead to the same complication. It is also true that fewer adhesions are separated and that the presence of the gall-bladder obscures direct external examination of the ducts if the gall-bladder is not removed.

It is undesirable to remove an organ with valuable functions like the gall-bladder, but when gall-stones are present the functions of the gall-bladder are largely in abeyance, and that the body can nearly always compensate successfully for the absence of the gall-bladder is a matter of constant experience.

In practice the real great objection to cholecystectomy is the fear of damage to the common hepatic or common bile ducts, a disaster which has probably happened on hundreds of occasions. The ducts may be damaged at two points.

(1) The junction of the cystic, common hepatic and common bile ducts (Fig 1). This may be the result of pulling on the gall-bladder and cystic duct when removal from the fundus is being attempted, or to inadequate exposure, or to congenital abnormalities, or to adhesions when it is being removed from the cystic duct end. Or it may be due to stones bulging from the cystic duct into the bile duct with perhaps some prolapse of the cystic into the larger duct.

(2) The common hepatic duct where it lies close to the cystic pouch (see Fig 1). The pouch overlaps the common hepatic duct anteriorly (or in some abnormal cases lies behind it). The separation of this part of the gall-bladder is extremely easy in a normal body, but with severe cicatrization in this region the cystic pouch may be closely adherent to the common hepatic duct. Possibly a fistulous communication sometimes occurs. It is in these cases that parts of the hepatic duct may be dissected off with the gall-bladder. Or the duct may be crushed with pressure forceps in seizing a bleeding point. Eisendiath¹ and Flint¹ have done very good service in studying and recording the frequent abnormalities of ducts and arteries which occur in these parts, but even helped by the knowledge they have supplied it is impossible always to dissect out clearly the different ducts, and some method is needed by which the ducts can be clearly and safely defined. It is here that the metal T-guide should be valuable. And this paper advocates its further trial in the hope that with longer experience it will fulfil its early promise of ridding this operation of cholecystectomy of its worst danger.

Of course all strictures of the biliary system are not post-operative. But the preliminary choledochotomy and passage of a conic probe and T-tube will early detect preexisting ulcerative strictures and lead to their correct treatment.

One must of course not make a fetish of cholecystectomy. If the patient's condition is bad, the dissection of the neck of the gall-bladder is offering great difficulties and no stones are left behind, simple drainage may be the wise course.

Very occasionally a partial cholecystectomy may be preferable, the fundus and body (where nearly all carcinoma begins) being resected without the cystic pouch or cystic duct.

In this part of China intrahepatic stone formation (possibly associated with clonorchiasis?) is not uncommon. In such cases there is no indication to remove the gall-bladder.

I am indebted to my clinical assistant, Dr S H To, for the care and skill he has devoted to the preparations of the illustrations for this article.

SUMMARY

This paper advocates the following principles in the treatment of gall-stones.

(1) The operation should be undertaken *at once* as soon as a reasonably probable diagnosis of gall-stones has been reached.

(2) That very free exposure of the biliary tract is desirable, preferably an angled incision such as Perthes' incision.

(3) That the bile duct should be opened just above the duodenum as a routine measure and the main ducts very thoroughly explored from within as well as from without.

(4) That the removal of the gall-bladder and cystic duct should generally (though not invariably) be practiced, the use of a metal T-tube protecting the main ducts from risk of injury.

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RUPTURE OF AN INTRAHEPATIC BILE DUCT WITH FATAL PERITONITIS

By WOODRUFF SMITH, M D

OF LADYSMITH, WIS

FROM THE DEPARTMENT OF PATHOLOGY AND BACTERIOLOGY OF THE YALE UNIVERSITY SCHOOL OF MEDICINE

THE purpose of this communication is to report an instance of spontaneous perforation of an intrahepatic bile duct, following complete obstruction of the common duct. When perforation occurred, the general peritoneal cavity was flooded with infected bile, and a fulminating peritonitis resulted.

Quite parallel instances of this unusual complication of gall-stone disease have been reported in the German literature, but in general it is an unrecognized contingency, and has not been considered along with spontaneous perforation of the gall-bladder and of the extrahepatic ducts, nor has it been brought into relation with other phases of the general pathology of the biliary tract. It is of interest at this time, in relation to a moderately large and increasing group of cases which are being reported as *Bile Peritonitis without Macroscopic Perforation of the Biliary Tract*, or under some title with similar implication.

HISTORICAL

In 1905, Nauwerck, of the University of Leipzig, reported two cases of intrahepatic bile duct rupture which were unexpectedly found at autopsy. The clinical picture in each instance was that of a fulminating peritonitis. The peritoneal cavity contained half a litre of green or brownish fluid which was found to issue from a minute point of perforation on the liver surface. The ampulla of Vater was completely obstructed by a calculus.

Four years later, Kariillon published a description of two more instances (from Nauwerck's Laboratory) in an admirable Inaugural Dissertation. In 1911, Rosenthal reported one instance with exploratory laparotomy and recovery. Vogel reported another in 1913, and Levin still another. In the same year, Nauwerck and Luebke added a fifth to the Leipzig series. Finally, Eimer reported two instances in 1915, bringing the total to ten.

During the same period, Kolisko, Professor of Legal Medicine at Vienna, appears to have seen a number of instances ("eine Reihe von Fallen") in the course of an extensive experience at the autopsy table. However, he gives the subject only a casual paragraph in a text-book article. Rosenthal refers to a brief note on an instance, from an unstated source in the "earlier literature."

CASE REPORT—History No 15738 New Haven Hospital. The patient was an obese white woman eighty-three years old admitted on February 19 1923 for the surgical treatment of supposed intestinal obstruction. She was, however, practically moribund and died three hours later without operation.

After her death, on questioning the relatives, it was discovered that for five years or more, at intervals of several months, she had had acute attacks of epigastric pain often initiated by a chill. At these times she always became more or less jaundiced, but the pain subsided in a day, and the color of the skin returned to normal rapidly. Aside from her abdominal attacks she had been unusually healthy, and even in her old age was quite vigorous. Her fatal illness seemed at first one of her usual attacks. She became definitely jaundiced soon after onset yet when a physician was called on the third day, this had faded completely. She was advised to come to the hospital where it was ascertained that her illness of four days began suddenly with dizziness and a short fainting spell, followed by severe and persistent abdominal pain. The only details learned at the time were that there was complete obstipation from the day of onset, and abdominal distention, which could not be relieved by enemas. She complained constantly of thirst, and took fluids well, vomiting once only, on the day before admission.

On examination, the patient was found restless and in pain. The mouth temperature was 100° F. The respirations were rapid but not labored. There was a state of auricular fibrillation, with an apex beat of 180 a minute. The peripheral pulse was too weak to be felt except over the temporal artery. Cyanosis was evident and slight pitting œdema of the ankles was present. The mucous membranes were dry, and the breath sweetish. The lungs were clear. The abdomen was distended and everywhere tender to palpation. No masses shifting dullness or fluid wave could be made out while the degree of obesity precluded the possibility of observing peristalsis. Pelvic and rectal examinations revealed nothing. The reflexes were moderately active and equal.

The white blood-cell count was 10,000 with 80 per cent polymorphonuclear cells. The urine showed a trace of albumin and was strongly positive for sugar, acetone, and diacetic acid. The presence of bile was not suspected grossly. In the urinary sediment were numerous pus cells, a few red blood-cells and an occasional hyaline and granular cast. The non-protein nitrogen of the blood was 86 mgms, the blood sugar 666 mgms, per 100 c.c.

The opportunity for clinical study was obviously too meagre to allow of a satisfactory diagnosis, but the cardiac irregularity, and the evidence of pancreatic insufficiency were the most impressive findings.

Post-mortem Examination—Autopsy No. 735. Brady Laboratory, New Haven Hospital. Complete autopsy was performed nine hours after death. For the sake of brevity the protocol is here given in detail only as concerns the pathology of the liver and biliary tract.

The abdominal cavity contained a cloudy dark green fluid whose quantity was estimated at 150 c.c. This fluid was everywhere present except in the lesser peritoneal sac. The intestinal surfaces were slightly granular here and there, but showed only a minimal injection. Small deposits of green-tinged plastic exudate were distributed over the surface of the liver and about the capsule of a small soft spleen. The left border of the omentum was adherent to the parietes in the iliac fossa, and had brought about an hour-glass constriction of the stomach as well as a kink in the transverse colon. From the point of kinking as far back as the cæcum the colon was dilated and thin-walled while the ileum was moderately contracted. The right border of the omentum was thickened and adherent to the under surface of the right lobe of the liver, covering the gall-bladder region completely.

When the gall-bladder was exposed by blunt dissection, it was found rounded, flaccid, and somewhat enlarged, measuring 9 cm. in length. Stones could be palpated within it, as well as in the cystic and common ducts. On manual manipulation of the gall-bladder and liver, a small additional quantity of the fluid previously described collected in the right renal fossa, but with the organs *in situ* no point of perforation could be found. The walls of the gall-bladder and extrahepatic ducts appeared everywhere thickened and pale. The liver, stomach, duodenum, and pancreas were removed *en masse*. Then the

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right and left hepatic ducts were severed at the hilum of the liver, after proximal and distal ligation

On opening the duodenum, the terminal portion of the common bile duct, for a distance of two centimetres, was found to project into the lumen of the intestine as a finger-like process. The opening of the papilla was clearly visible at the tip of this process but fluid could not be expressed through it. Cross-section of the proximal third of the pancreas permitted the escape of cloudy green bile from the duct of Wirsung until the gall-bladder was completely drained. Injection of Pick's fluid by way of the pancreatic duct caused the bile ducts and gall-bladder to become distended again without leakage at any point in the tract. The presence of complete obstruction of the common duct was further supported by the milk-white color of the contents of the entire intestine.

After fixation of the specimen, consisting of gall-bladder and ducts, for twenty-four hours in Pick's fluid, the dissection was carried to the point indicated in Fig. 1. The common bile duct measured 12 mm. in diameter, and was joined by a dilated pancreatic duct at the ampulla. The ampulla was blocked distally by a rounded gall-stone which remained fixed in its bed during the dissection. Other concretions lay free in the gall-bladder and in the ducts. The mucosal surfaces were uniformly bile stained and showed a lacy reticulation throughout. There were no ulcers. Microscopically, the thickened walls of the gall-bladder and common duct were diffusely infiltrated with round cells, and gland-like crypts of the epithelial lining were numerous in both structures.

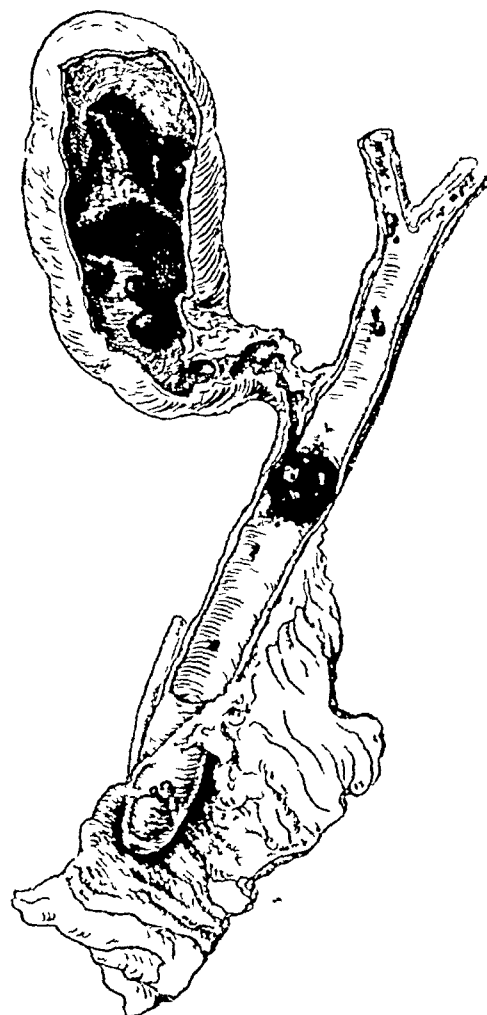


FIG. 1.—Complete obstruction of the ampulla of Vater, with dilatation of the common bile duct.

The liver appeared small, and weighed only 1100 grams. Except for a scarred area on the anterior aspect of the right lobe the capsule was translucent while the liver substance beneath showed an irregularity of surface in low relief. The cut surface of the organ had a brownish-yellow color, and was marked by innumerable darker red dots. Jaundice was evident, the tissue turning green on contact with Zenker's fluid. Nowhere in the parenchyma were there foci which could be interpreted as possible cholangitic abscesses. In a number of microscopic sections of the liver slight amounts of fat and deposits of golden pigment within parenchymal cells of the central zone of the lobule were observed. The interstitial tissue of the portal spaces was infiltrated with both lymphocytes and polymorphonuclear cells. Larger bile ducts frequently contained small collections of pus cells and bacterial masses. Here and there ulceration of the mucosa was associated with purulent infiltration of the wall of the duct. Larger lymphatics were filled with pus cells. The branches of the sclerotic hepatic artery and of the veins failed to show thrombi. Definite abscesses of the liver were not found microscopically.

Ruptured Intrahepatic Bile Duct.—Since the extrahepatic portion of the biliary

tract showed no perforation, the liver was more closely inspected, the findings may be described as follows. On the anterior aspect of the right lobe, just over the gall-bladder fossa, there is an irregular area of grayish color whose surface is thrown into shallow folds. The area is broadest at the liver edge and somewhat depressed, but becomes narrower as it extends toward the dome. Within it, 15 mm above the right border of the gall-bladder notch, there appears a small green-stained papilla with a minute central crater (Fig 2). On section through the liver perpendicular to the surface, there is found a superficial layer of gray-white fibrous tissue, in which a few prominent blood-

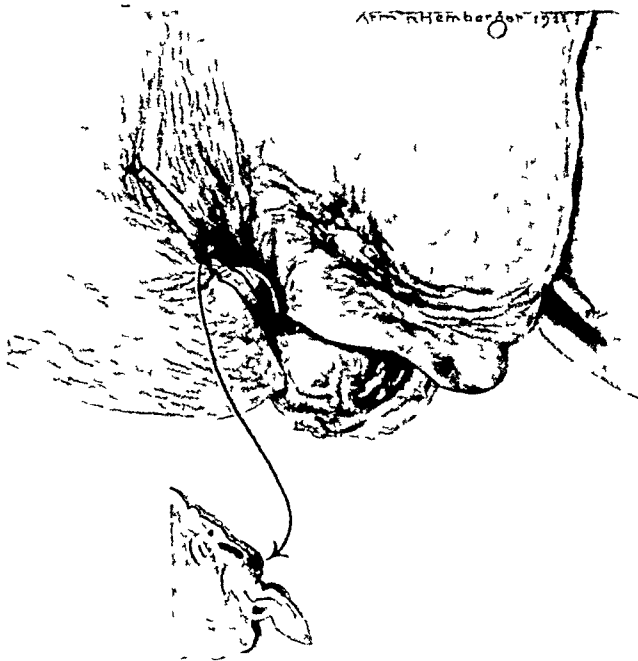


FIG 2—Chronic and acute cholangitis and cholecystitis. Rupture of intrahepatic bile duct through Glisson's capsule into the peritoneal cavity.

vessels are imbedded, together with a plexus of bile ducts recognized by their green stain. One of these ducts leads to the small papilla of the liver surface, and it can be traced, in parallel cuts, across the roof of the gall-bladder fossa. Here it dips down away from the surface to join a primary branch of the right hepatic duct at the hilum. Measuring peripherally less than 1 mm in diameter, it increases in size as other tributaries join it, to furnish the point of perforation with an extensive drainage of bile by back flow.

A block of tissue containing the papilla was imbedded in paraffin, and sections cut serially, 10 micra thick, were stained with hematoxylin and eosin. In addition to the gross drawings, accurate reproductions of selected sections have been made by Mr Armin B. Hemberger. These were chosen at

intervals varying from 150 to 210 micra. The magnification of low and high power drawings is approximately 8 and 40, respectively.

A Microscopic Note on the Point of Perforation—The superficial grayish zone of the liver surface consisted of dense connective tissue in which only blood-vessels and bile ducts are imbedded. Glisson's capsule was sharply differentiated from the underlying connective tissue as a thin membrane occasionally beset by small fibrin masses. This membrane was intact as far as the slopes of the papilla, where it became necrotic and, with the tissue beneath, bile stained. There was polymorphonuclear infiltration of the connective tissue about the papilla, with small hemorrhages, and an early proliferative reaction had also manifested itself. Bile ducts of various diameters occurred in the scar, the smaller as a rule had a more definite epithelial lining than the larger.

Throughout the serial sections, ramifications of one of the larger ducts lay parallel to and quite near the capsule of Glisson, and passed beneath the base of the papilla. Although the surrounding tissue was oedematous and bile stained, the segment of the duct close to the point of rupture had a well-preserved fibrous wall, partly torn toward the liver capsule (Sections 1 and 2, Fig 3). Bile was found as a golden brown mass within the duct and bridged the tear in its wall. A leucocytic collection appeared only at one lateral angle of the duct. In succeeding sections the duct opened widely into the open crater of the papilla. Here the outward aspect of the duct wall had become necrotic. Bacterial masses and cellular debris were found in the opening. The crater

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of the papilla became covered by a necrotic but recognizable membrane and the base was formed by a duct wall (Section 1, Fig 4) From this point the cellular infiltration of the papilla increased, but the major duct shifted its position, leaving only smaller tributaries in the region of the papilla Finally one of these smaller ducts appeared at the centre of a definite miliary abscess, directly beneath the slopes of the papilla (Section 2 Fig 4, Sections 1 and 2, Fig 5) The reaction here was essentially purulent, and evidence of bile staining was absent

From a study of all the serial sections it appeared that the miliary abscess formed

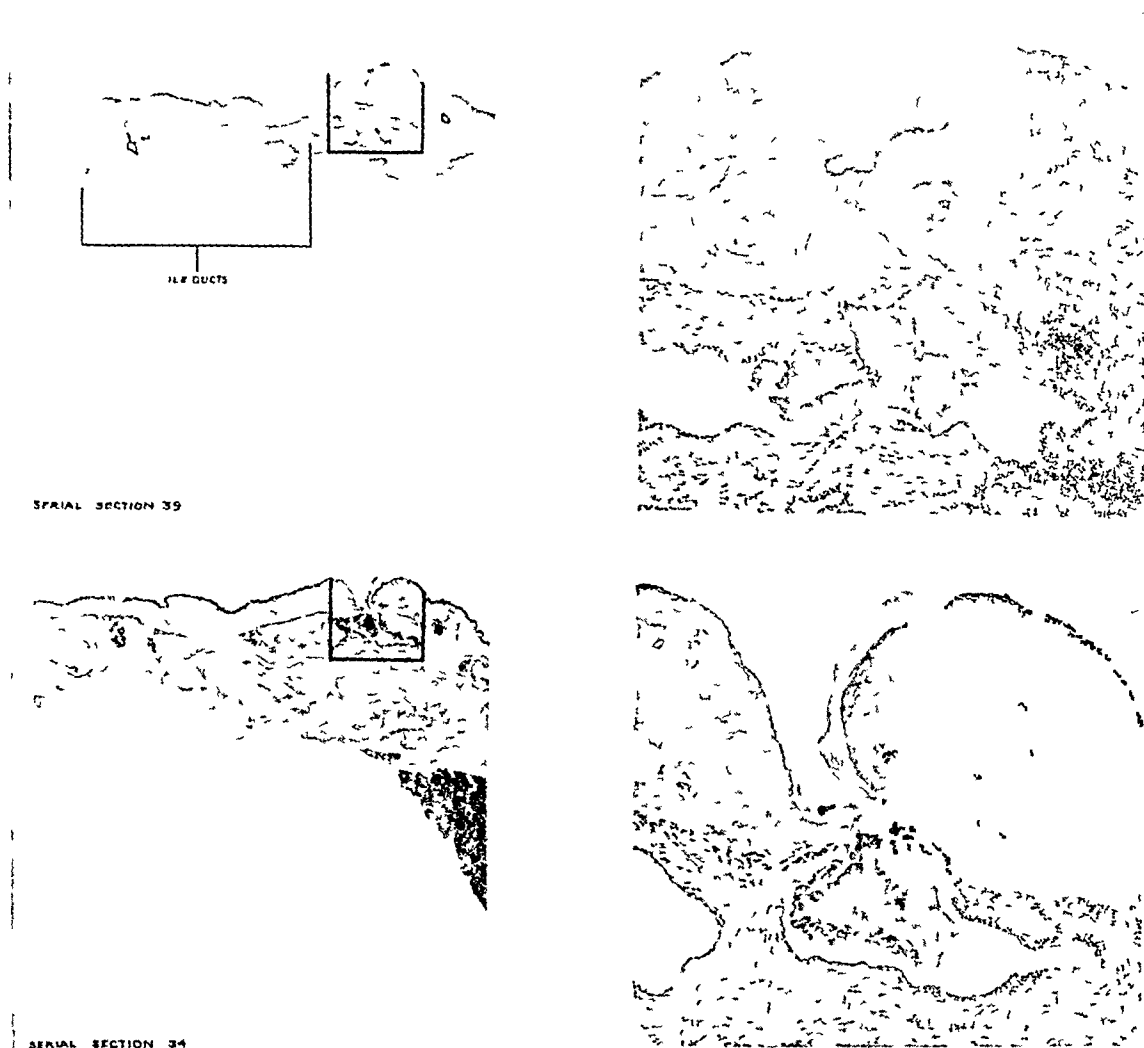


FIG 3 —Microscopic sections of the point of rupture The open crater of the papilla may be seen

primarily in the smaller tributary, and that rupture of the larger duct resulted from subsequent necrosis of the surrounding scar and of the duct wall, under conditions of increased bile pressure due to obstruction of the common duct

Complete Anatomical Diagnosis—Primary—Chronic cholecystitis and cholangitis with stones, hepatic fibrosis with local dilatation of the bile ducts, calculus obstruction of the ampulla of Vater, jaundice, acute pancreatitis, acute cholangitis, rupture of miliary cholangitic abscess with escape of bile into the peritoneal cavity, acute generalized peritonitis, acute splenic tumor, cloudy swelling of the viscera

Subsidiary—Senility, generalized arteriosclerosis, fibrosis of the myocardium, pulmonary emphysema, chronic osteo-arthritis, fibrous peritonitis, atresia of the appendix Lipomatosis of the pancreas with hyalinization and hypertrophy of the insular tissue Meningeal endothelioma Lipoma of the transverse colon

Bacteriological Report—Cultures of the heart blood and peritoneal fluid remained sterile. Direct smears of the peritoneal fluid showed pus cells, and innumerable Gram-positive streptococci forming long chains.

GENERAL CLINICAL AND PATHOLOGICAL FEATURES

The twelve reported instances of intrahepatic bile duct rupture have occurred in the latter half of life, and ten were in females. There has usually been a past history of biliary colic. The final illness has been sudden in onset.

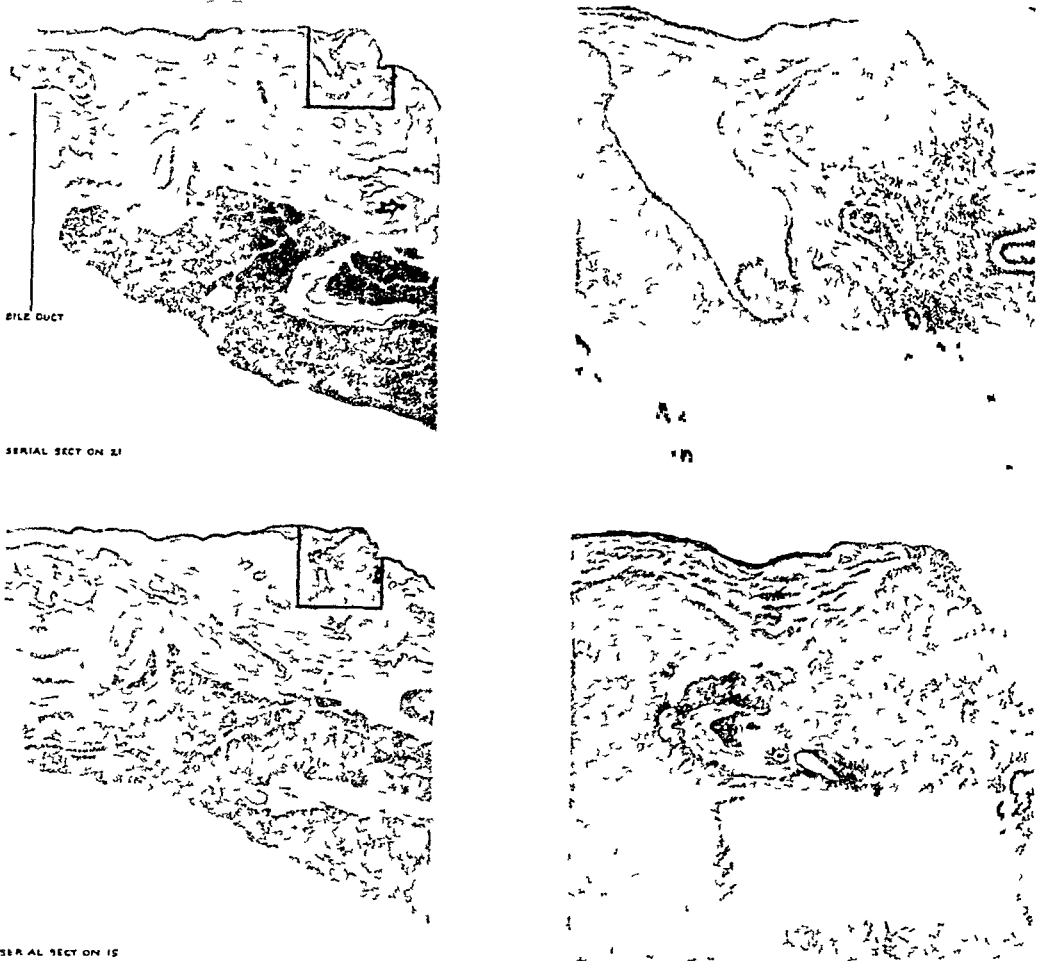


FIG. 4.—Microscopic sections of the point of rupture. Necrotic membrane covers the ruptured duct at the liver surface.

and short differing from earlier attacks of obstructive jaundice chiefly in its fulminating character. The elevation of the pulse and the prostration are striking, and out of all proportion to the rise in temperature. Abdominal tenderness generally on the right side, and marked distention are noted. Signs of free fluid have not often been obtained. Jaundice of variable degree is mentioned. Occasionally acholic stools are passed, but more often, with the distention, there is obstinate constipation. Twice, sugar has been found in the urine.

Anatomically, there is evidence in every case of intermittent or constant obstruction of the biliary system over a considerable period of time. The

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ducts are dilated, and the gall-bladder dilated, or else scarred and contracted. Gall-stones have always been present, serving as a cause of obstruction with the exception of two instances of malignant disease. The liver has appeared atrophic in one or both lobes. Cholangitic abscesses have never been found in the organ at large, although jaundice of the liver and chronic and acute cholangitis prove to be a prominent part of the microscopic picture. The point of rupture lies in a scarred area of the liver surface. Ectatic ducts, that look like minute cysts, project beneath the capsule of Glisson, in the

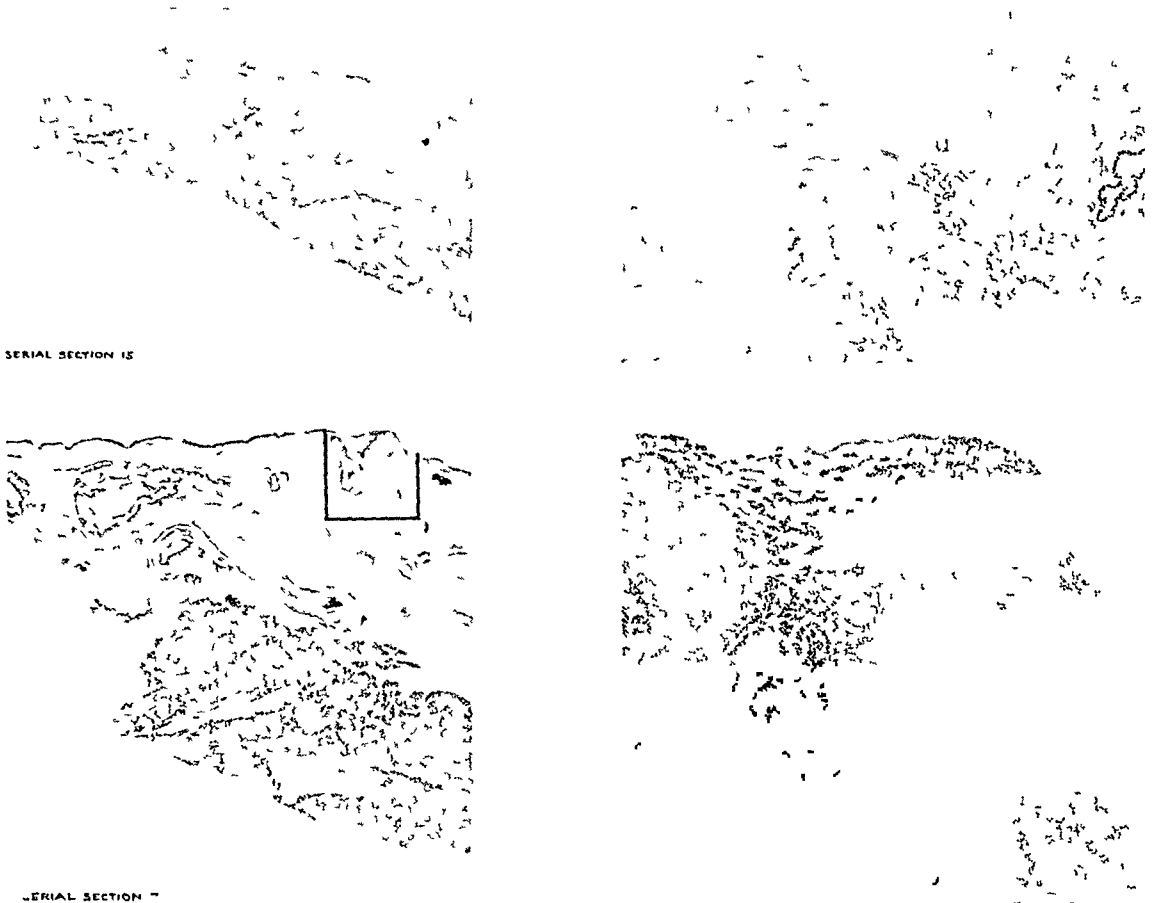


FIG 5 —Microscopic sections of the point of rupture. Toward one slope of the papilla is found a military abscess.

experience of most observers. Usually, the perforation occurs in the left lobe of the liver, or on the anterior surface of the right lobe, over the gall-bladder fossa.

The peritoneal exudate has varied from a small quantity of fluid to 1200 c.c. Bacteriological findings (culture or microscopic examination of tissue or smears) are mentioned seven times: *B. coli* (3), *B. coli* and streptococcus (3) and streptococcus (1).

Of the reported cases, that of Levin is so exceptional as to deserve a more detailed description. Rupture of the biliary channels of the liver was unassociated with biliary tract infection, but resulted from obstruction of the extrahepatic ducts by the growth of a gastric carcinoma. Consequent to perforation, a pocket of sterile bile collected and became encapsulated in the peritoneal fossæ about the liver. The collection of bile may have been

TABLE I

Authors	Sex and age	Past history	Final illness Clinical picture	Duration and result	Cause of obstruction to the biliary system	Biliary tract pathology	Bacteriology	Point of perforation of intrahepatic duct	Peritoneal exudate quantity and character
Older literature (Rosenthal-1911)	Male 63			Fatal probably	Choledochus stricture probably of calculous origin	Dilated intrahepatic ducts markedly distended with bile		Edge of liver	Purulent
Kolsko-1913 'Eine Reihe von Fällen					Gall stones			More often in the left lobe	
Nauwerck-1905 Also by Karrison-1909 Case 1	Female 49	Negative for jaundice or colic	Sudden onset Jaundice thirst vomiting No bowel movements Abdominal pain and distention Resistance and tenderness on right side Elevated pulse and temperature Finally light colored stools	4 days Fatal	Stone in the ampulla of Vater	Gall-bladder dilated Left lobe of liver atrophic with biliary cirrhosis Stones in left hepatic duct Liver ducts generally dilated and thickened especially in the left lobe These ducts often form ampullæ as large as a hemp seed on the liver surface covered only by a thin membrane	B coli Streptococci	Bridge of tissue between left and quadrate lobes over the round ligament	550 c c ofropy brownish-yellowish fluid Cloudy containing flakes of fibrin
Nauwerck-1905 Also by Karrison-1909 Case 2	Female 69	Years of painful abdominal attacks with jaundice	Moribund when seen	Fatal	Stone in the ampulla of Vater	Gall-bladder small and fibrotic with an ulcer of the neck Liver enlarged but left lobe is atrophic with biliary cirrhosis Stones in ducts of left lobe Ecstatic ducts of surface of left lobe visible grossly Duodenal papilla projects due to distention and stone	B coli	Posterior angle of left lobe	500 c c ofropy, brownish fluid strongly positive for bile Plastic peritonitis as well
Karrison-1909 Case 3	Male 66	Negative for the biliary system Chronic mitral and aortic endocarditis	Sudden onset patient senile and cachectic Light jaundice Vomiting Cardiac irregularity coarse râles in lungs Abdominal distention and resistance No feces and even after enemata Enterostomy performed on 3rd day	6 days Fatal	Stone impacted in common bile duct	Gall-bladder dilated Liver jaundiced but not cirrhotic except for scarring of surface of left lobe Left intrahepatic ducts especially dilated Pus in ducts and polymorphonuclear infiltration of ectopic ducts of liver surface	B coli Streptococci	Anterior margin of left lobe	Small amount of yellowish-brown fluid (previously drained by laparotomy) Plastic peritonitis

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Karrillon-1909 Case 4	Female 59	For one year frequent at- tacks of vom- iting and jaundice	Probable acute onset Patient cachectic and markedly jaundiced when seen Abdominal distention and epigas- tric tenderness Fibrin- ous pleurisy Trace of sugar in the urine	About 4 days Fatal	Gall-blad- der carci- noma en- veloping hepatic duct	Carcinoma of gall-bladder with metastases to regional lymph- nodes and liver Small gall- stones above obstruction of he- patic duct by tumor Liver ducts dilated and thickened Cherry- stone-sized cystic ducts of an- terior and posterior surface of left lobe At point of rupture alone polymorphonuclear infil- tration suggests cholangietic abscess	Strepto- cocci and Diplococci	1 Anterior surface of left lobe 2 Posterior surface of left lobe	75 cc of cloudy yellow fluid Peritoneal surfaces little altered
Rosenthal-1911	Female 49	Three months before an ill- ness of seven days with copious vom- iting Gen- eral health good	Sudden onset Severe epi- gastric pain for one day Five days later showed jaundice, abdominal dis- tention, and tenderness in right hypochondrium Liver enlarged Acholic stool On 7th day an acute attack of abdomi- nal pain with increasing distention Laparotomy	7 days Cured	Common duct stones	Gall-bladder contracted and con- tained stones Anterior surface of liver over the gall-bladder wrinkled Cystic ducts visible here, pea-sized Common bile duct widely dilated and con- tained numerous stones		Anterior sur- face of right lobe over gall- bladder fossa	500 cc of thick cloudy bile Intestinal sur- faces reddened and glued together
Nauwerck and Leubke-1913	Female 73			Fatal	Common duct stones	Gall-bladder distended and con- tained stones Perforation of dilated subserous bile duct of the liver		Upper surface of the right lobe	1200 cc of practically pure bile Fi- brinous peri- tonitis
Vogel-1913	Female 72		Several days of intense pain in upper right ab- domen with obstipation On admission to hospi- tal jaundice cardiac arrhythmia distended ab- domen tender especial- ly on the right tumor palpable in gall-bladder region Sudden collapse after 5 days in hospital with disappearance of the tumor	8 (?) days Fatal	Not defi- nitely de- termined Probably gall-stones	Gall-bladder showed inflamma- tory changes was flaccid, and contained many stones Left lobe of liver atrophic		Under surface of left lobe	Diffuse bile peritonitis, with fibrinous deposits
Ermer-1915 Case 1	Female 68		Cachexia, icterus Palp- able nodular liver Vom- iting before death	4 days Fatal	Adenocar- cinoma of common bile duct	Gall-bladder tense and filled with stones Neoplastic invasion of anterior gall-bladder wall and liver Schnurfurche of the enlarged liver in which an ecta- tic subserous duct had ruptured	B coli	Anterior sur- face of right lobe	Generous a- mount of dark greenish brown fluid Fibrinous peri- tonitis

sort have been reported on the basis of operative or autopsy findings, and the question of filtration of bile through an unbroken gall-bladder wall has been considered by a number of observers. To confirm or overthrow this hypothesis some experimental work has been done, while the field has been reviewed repeatedly of late, notably by Buchanan (1918), Ritter (1921), Wagner (1922), and Burckhardt (1923).

Seventy-three cases are mentioned in Burckhardt's paper, including a few obscure but verified perforations, as well as a few instances in which the biliary character of the peritoneal effusion was doubtful. The relatively large number of cases is striking as contrasted with the scarcity of reports on spontaneous perforation of the cystic, hepatic, and common bile ducts, of which there are probably not more than twenty in the available literature, including the eight which McWilliams has collected.

In the great majority of the cases of unexplained bile peritonitis the operator or the pathologist was convinced that the peritoneal cavity contained bile, although no point of escape from the gall-bladder or bile ducts could be found. Noteworthy pathological changes of the biliary tract were always present. The peritoneal exudate varied in character and amount, as did the severity of the peritonitis. The various theories that have been offered to explain the phenomenon fall into two main groups. First, is the belief that diffusion of bile salts through a gall-bladder wall may take place in gangrenous cholecystitis, so that a peritoneal exudate is stained brown or green. *The question may well be raised whether the mere presence of bile pigments in a peritoneal exudate is germane to the subject under discussion. It is the belief of the writer that bile peritonitis should be defined as an inflammatory reaction of the peritoneum caused by infected bile.* Second, that a perforative lesion of the biliary tract has been overlooked. This may be a microscopic or minute macroscopic rent in the walls of the gall-bladder or bile ducts, or it may be a small perforation which has subsequently healed or become covered with plastic exudate. A study of the accumulated literature at first hand brings the strong conviction that no single mechanism will explain all instances. Nevertheless, in cases of bile peritonitis of obscure origin, the bile ducts of the liver surface must always be considered as possible points of perforation.

Pathogenesis of Intrahepatic Bile Duct Rupture—Although rupture of intrahepatic bile ducts is apparently rare, scars of the liver surface containing dilated bile ducts are common. Under conditions of infection and obstruction these conceivably may rupture and allow infected bile to escape into the peritoneal cavity. In fact, Karrillon and Ermer reached this decision after detailed histological study. These observers differ, however, in the interpretation of the mechanism concerned with the actual rupture. Karrillon assumes a critical moment of high pressure which leads to dehiscence of the walls of the ectatic duct, while Ermer is inclined to believe that the duct does not burst

RUPTURE OF AN INTRAHEPATIC BILE DUCT

acutely but that the rupture is brought about by pressure necrosis acting from within the duct upon a poorly vascularized scar

From the facts gathered by study of the instance herewith reported it is believed that the mechanism of rupture is explicable on the following basis Chronic inflammation of the biliary channels with gall-stones had existed for several years An exacerbation of the inflammatory process involved a group of ectatic bile ducts in a small scar beneath the liver capsule Necrosis with rupture was a natural consequence

SUMMARY

1 In the course of chronic and acute cholangitis with obstruction to the hepatic or common bile ducts, perforation of a bile duct of the liver surface may occur

2 The incidence of such perforations is probably higher than reports indicate This fact may have a bearing on the reports of bile peritonitis without macroscopic perforation of the biliary tract

3 The perforated liver duct is often dilated and is found in a scarred area of the liver surface where the liver parenchyma has been replaced by fibrous tissue

4 The cause of perforation is the formation of a miliary cholangitic abscess near an ectatic bile duct, in a superficial scar of the liver

The author takes this opportunity of expressing his indebtedness to Dr M C Wintermütz, in whose laboratory this paper was written

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THE MECHANISM OF INTESTINAL PERFORATION DUE TO DISTENTION*

BY FREDERICK T. VAN BEUREN, JR., M.D.
OF NEW YORK, N. Y.

INTESTINAL perforation following prolonged over-distention is quite a different entity from perforation resulting from an intestinal ulcer. It is of much less common occurrence and appears, so far as I have observed, only in cases of mechanical ileus. The perforation in such cases is generally situated upon the antimesenteric surface of the intestine, usually quite close to the point of obstruction.

It is surrounded by an area of discoloration generally diamond-shaped or of an irregular shape resulting from the coalescence of two or more diamond-shaped areas. These diamond shapes correspond roughly to the terminal anastomotic tree of the intestinal vessels and are evidently the result of hemorrhage from these vessels.

that is, hemorrhagic infarct of the area supplied. The mechanism of this infarction appears to be as follows.

Distention of the intestine increases its diameter. Any increase in its diameter is tripled in its circumferential measurement. In other words, if the diameter of an intestine is increased by distention from 1 cm. to 3 cm., its circumference is at the same time increased from 3 cm. to 9 cm. Thus, the difference in the diameter is only 2 cm., while the difference in the circumference is 6 cm. A moderate increase in diameter, therefore, results in considerable stretching of the wall. The intestinal vessels pass between the layers of the wall along its circumference from their origin at the mesenteric border to their terminal anastomoses at the antimesenteric surface, becoming progressively more thin-



FIG. 1—S. P. No. 7489. Intestine obstructed 144 hours. Small hemorrhagic areas in region of terminal intestinal vessels.

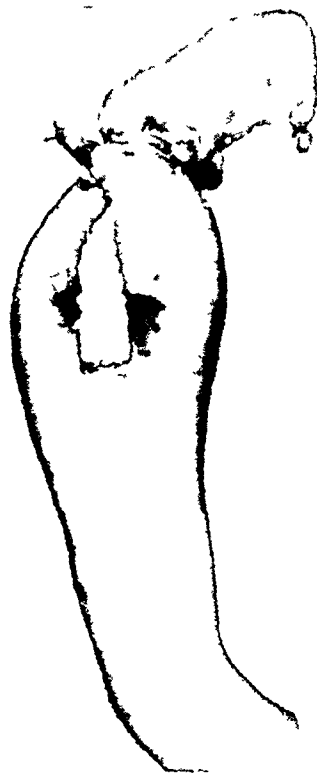


FIG. 2—S. P. No. 5882. Intestine obstructed 12 hours. Diamond-shaped infarct on antimesenteric surface with section out for microscopic examination.

* Read before the Southern Surgical Association, December 12, 1923.

walled and more narrow of lumen. Because they are elastic the stretching of the intestinal wall from distention still further thins the vessel walls and narrows the vessel's lumen like a stretched rubber tube. At the same time the pressure from within the intestine tends to flatten out the vessel's lumen.

The narrowing of the vessel's lumen and the thinning of the vascular wall are maximum at the antimesenteric surface of the intestine where the terminal anastomoses occur, and, the distention pressure being constant throughout the lumen of the intestine, the maximum effect is seen at the antimesenteric surface where a union of the three factors of pressure, thin wall and narrow lumen finally results in obliteration of the vessel. This obliteration occurs sooner in the vein than in the artery on account of the less resistant wall. The blood continues to pour through the arterial vessel until the pressure against the obliterated vein suffices to rupture the vessel

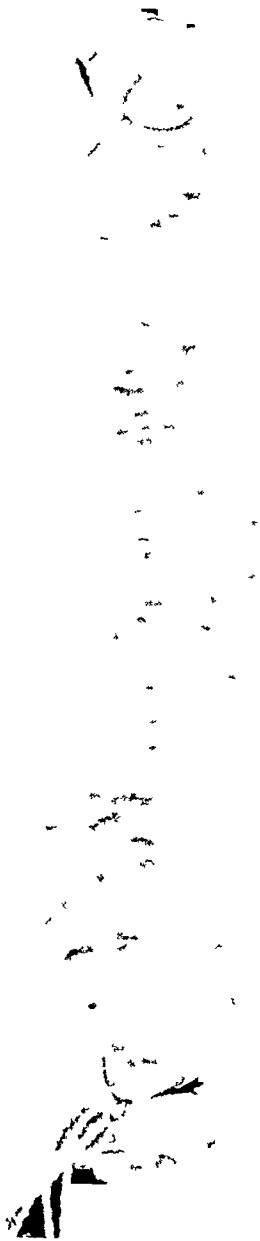


FIG 3—S P No 7471. Intestine obstructed 77 hours. Multiple infarcts on antimesenteric surface

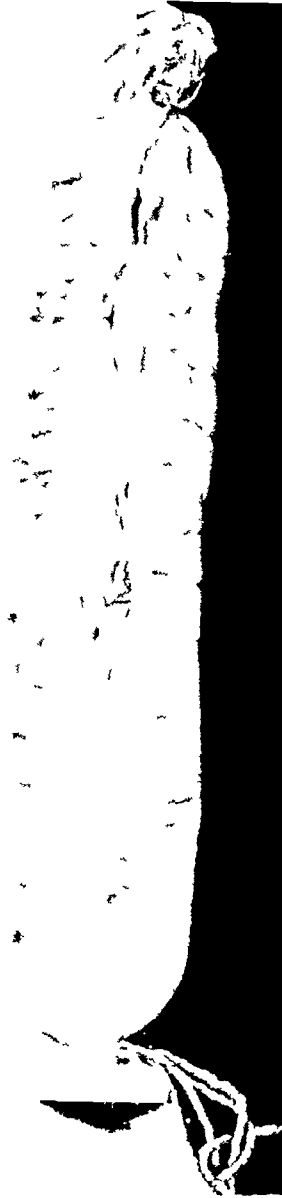


FIG 4—S P No 7471. Mesenteric surface of same specimen as Fig 3. Absence of infarcts on mesentery

wall and permit extravasation and coagulation. Finally, the pressure occludes the artery as well as the vein. The area of tissue supplied by these terminal vessels is thus deprived of circulating blood and necrosis occurs. This necrosis is usually first evident in the submucosa and inner muscular coat, but rapidly extends to the other coats of the intestinal wall, and perforation

INTESTINAL PERFORATION DUE TO DISTENTION

may occur within twenty-four hours after the discoloration due to the hemorrhagic infarct has been first noticed

It will be noted that hemorrhagic infarcts and perforations resulting from their necrosis cannot be expected to occur at any regular interval after obstruction, because the degree of distention varies so much in the individual cases and the infarction appears to depend entirely upon distention sufficiently prolonged and in excess of the normal limit



FIG 5—S P No 5946 Intestine obstructed 180 hours Coalescence of necrotic hemorrhagic infarcts into gangrenous area on antimesenteric aspect just above point of obstruction

The first twelve illustrations are of material from dogs operated upon in the laboratories of the Department of Surgery, College of Physicians and Surgeons, Columbia University The last four are from a clinical case operated upon at the Presbyterian Hospital

Figure 1 shows an intestine that had been obstructed 144 hours Several small hemorrhagic areas can be seen in the region of the terminal intestinal vessels

Figure 2 shows quite distinctly the usual diamond-shaped form of the hemorrhagic infarct from which, in this instance, a section has been removed for microscopic examination This intestine was obstructed for 72 hours

Figure 3 shows multiple hemorrhagic infarcts in an intestine that had been obstructed only 77 hours This specimen shows excellently the situation along the antimesenteric surface, while

Figure 4 shows the mesenteric border of the same specimen of intestine exhibiting no hemorrhagic areas near the mesenteric border



FIG 6—S P No 7483 Intestine obstructed 120 hours Perforation due to necrosis of hemorrhagic infarcts on antimesenteric surface

three of which have coalesced to form an irregular discolored area on the antimesenteric surface near the blind end of the oral segment of the intestine This specimen was taken from an intestine obstructed for about 180 hours

Figure 6 shows a perforation near the blind end of the oral segment of an intestine that had been obstructed about 120 hours. The irregular diamond-shaped area of discoloration (which was very evident in the fresh specimen) around the perforation does not show distinctly in the photograph.

Figure 7 shows an interesting comparison of the pressure effects on thinning the intestinal wall, the two upper specimens having been obstructed only 48 hours, the two middle ones for 72 hours, the next to the lowest for about 96 hours, and the lowest for 180 hours.

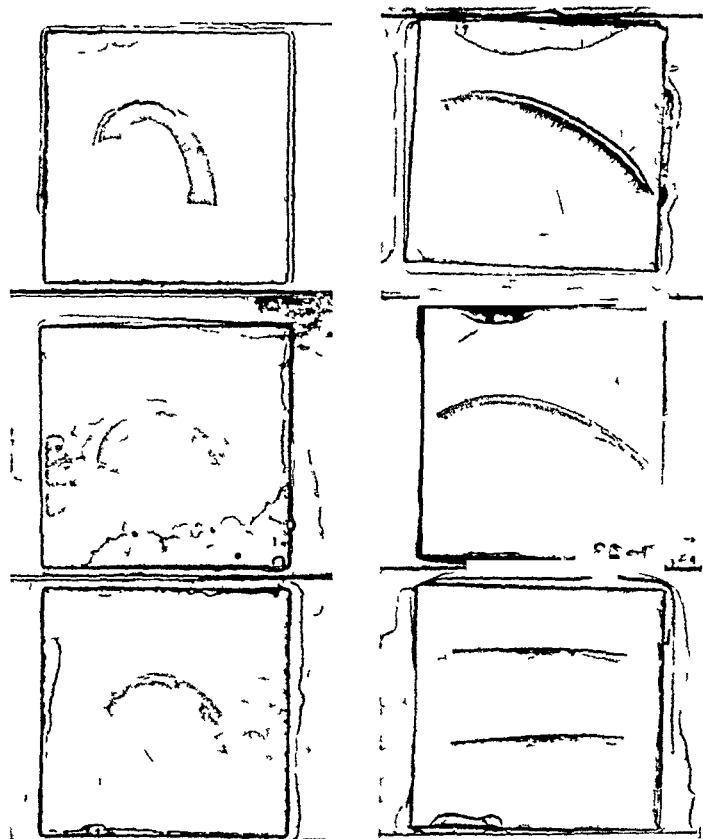


FIG 7—S P Nos 5922 5935 5882 5883 5944 5946 Intestines obstructed from 48 hours to 180 hours. Progressive stretching and thinning of intestine due to distention.

Figure 8 shows how the beginning of infarction probably appears microscopically where congested, thrombosed vessels are seen in the submucosa of an intestine obstructed for 72 hours.

Figure 9—Extravasation has occurred from over-filled blood-vessels, both in the submucosa and in the muscular coat.

In Figure 10 the extravasation has increased in size, and the pressure is presumably greater.

In Figure 11 necrosis is well-advanced, and the integrity of the wall is gravely threatened.

In Figure 12 the completely necrotic area of the perforation is shown.

Figure 13—Serous surface of human intestine obstructed about 130 hours. Hemorrhagic infarcts may be seen at A, B and C.

Figure 14—Same intestine photographed by transmitted light (somewhat similar to a radiograph). Hemorrhagic infarcts at A, B and C.

Figure 15—Low power photomicrograph of section of same showing scattered submucous hemorrhages.

Figure 16—Same showing single large submucous hemorrhage.

The last four figures are taken from the human case whose history follows (I am indebted to Dr F B St John for the opportunity of reporting it.)

CASE I—S W, a woman of thirty-eight years, came to the Presbyterian Hospital on the night of October 2, 1923 with a history of abdominal pain which had begun seventy-two hours before and had shortly been followed by nausea and vomiting. The pain, though varying in intensity and moving from upper to lower abdomen, had persisted,

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and the vomiting had been repeated several times each day but had not assumed a fecal character. Her bowels had moved on day of onset but not since. A cathartic taken the day before admission had been promptly vomited, and an enema given on the day of admission had returned practically unchanged. She was worried by the fact that she had passed no flatus, but she complained of no undue abdominal distention. The only relevant items of her past history were an appendicectomy, four years previous, and an

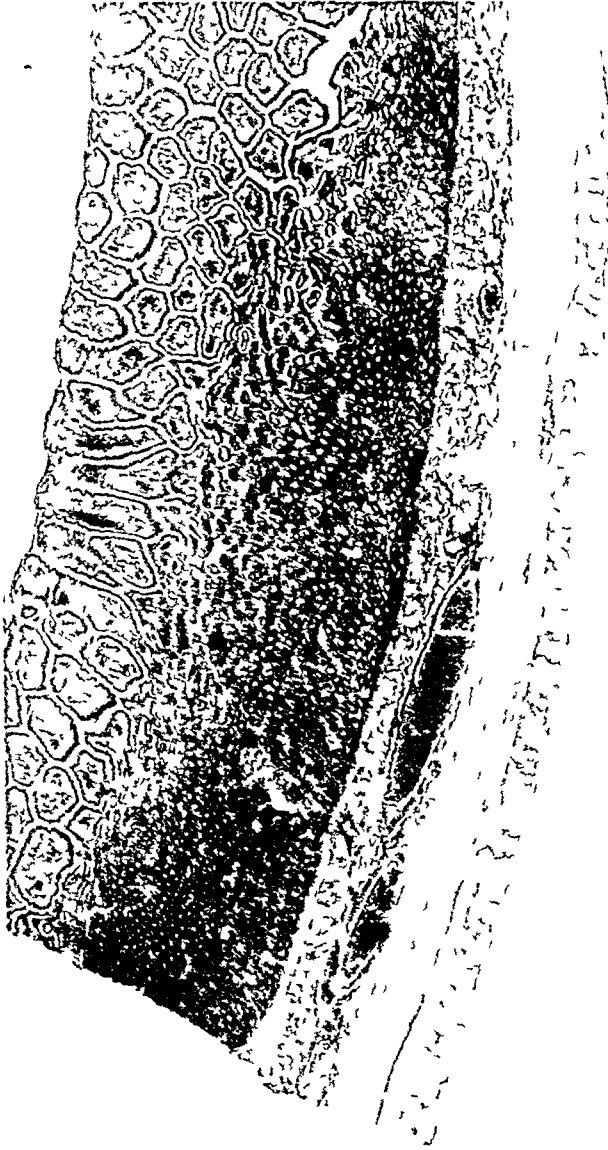


FIG 8—S P No 5922 Intestine obstructed 48 hours
Thrombosed vessels in submucosa



FIG 9—S P No 7480 Intestine obstructed about 72 hours
Extravasation in submucosa and muscularis Beginning of hemorrhagic infarct

attack of abdominal cramps, nausea and vomiting that lasted twenty-four hours, one year previous to onset of her present illness.

On admission, she was apparently in some pain but did not appear to be very ill. Her pulse, blood pressure, temperature, and respiration, were within normal limits, and her urine was normal. Her white blood count was about 14,000 polymorphonuclears 80 per cent. Heart and lungs negative except for a few râles at left apex posteriorly. The abdomen was not distended and moved with respiration. Its lower half was rather more prominent than the upper and was less tympanitic on percussion. There was no visible peristalsis and no stiffening of the gut was felt. A small oblique scar in right lower quadrant indicated the old appendicectomy. There was slight tenderness, both direct and release, more marked to left of midline and slight muscle spasm which was thought to

he chiefly voluntary. There was slightly increased discomfort when uterus was moved in pelvic examination. There were no feces in rectum. Otherwise the physical examination was negative. A diagnosis of partial intestinal obstruction due to adhesion was made and as she appeared to be in good condition and had recovered spontaneously from her previous attack a year before, palliative treatment by poultices, enemas, colon

irrigation and hypodermic injection was begun.

During the first 48 hours after admission 5 out of 6 colon irrigations given, brought away feces and flatus. Her temperature, except for one observation, remained below 100° F, her pulse below 90, her respiration below 20. Her white blood count fell to 9,000, polymorphonuclears 61 per cent. She vomited several times, however, her abdomen became distended, her urine showed a trace of albumen, her blood urea was found to be quite high and her general condition looked less favorable. On the morning of the third day (almost 60 hours after admission and 120 hours after onset) Dr Barclay Parsons operated under ether anesthesia. Upon entering the peritoneal cavity greatly



FIG 10—S P No 7471. Microscopic section from specimen shown in Fig 3. Large extravasation. Wall much thinned by pressure.



FIG 11—S P No 7489. Microscopic section of specimen shown in Fig 1. Advancing necrosis of infarcted areas.

distended injected loops of swollen intestines presented. There was no free fluid. In the right lower quadrant there was a broad band of adhesions extending upward from the cecum and terminal ileum to the anterior abdominal wall just below the old scar. There was no evidence of kinking here and no constriction of the intestines. Upon exploring the ileo-cecal region, however, the intestines were found to be bound down as if by internal herniation behind in the ileo-cecal fossa. Manipulation freed the loop which presented a constriction proximal to which the gut was greatly distended, reddened and of paper-thin consistency. Distal to the constriction, the gut was collapsed but the great discolor-

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ancy in diameter diminished rapidly while the loop was being examined. While exploring the intestine a fecal odor was noticed and fecal contents were discovered leaking from an opening in the distended gut. This opening was about 1 cm in diameter, resembled a tear rather than an ulceration and was situated about half way between mesenteric border and antimesenteric surface. The mesentery in this region was very much injected



FIG 12 —S P No 7183 Microscopic section of specimen shown in Fig 6. Completely necrotic edge of perforation.



FIG 13 —P H Autopsy No 9426 Hemorrhagic infarcts at A, B and C on antimesenteric aspect of intestine which has been split open along its mesenteric attachment.

and somewhat thickened but there were no noticeably enlarged lymph-nodes. A short distance away, the serosa of the gut split for a distance of 2 cm merely when pressure was exerted upon an adjacent loop. There was no pathology noted other than the distended, congested, friable intestine above the point of obstruction, and the collapsed intestine distal to it.

The split serosa was repaired, the rim of the perforation in the intestine excised and the aperture closed. An enterostomy was made and the wound closed with drainage.

Microscopic examination of the specimen excised showed that the mucosa was intact in many places. In other places the epithelium was absent, and both mucosa and submucosa showed hemorrhage. The submucosa and muscularis were edematous and in places showed degeneration and hemorrhage and all layers were infiltrated with



FIG 14—Same specimen as in Fig. 13 showing infarcts by transmitted light at A B and C

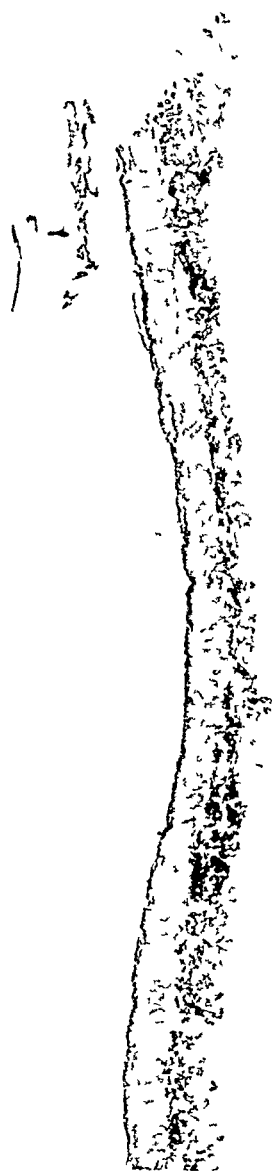


FIG 15—P. H. Autopsy No 9426 Low power of intestine showing very small hemorrhagic infarcts in submucosa

leukocytes. The patient died about five hours after operation, with signs of acute respiratory and cardiac failure.

At autopsy, a pulmonary embolus was found and the intestine showed the striking changes due to over-distention resulting in hemorrhagic infarction. One of the areas of infarction had presumably necrosed to the point of perforation, but it was not definitely determined whether perforation had been spontaneous or had been induced by the necessary handling of the gut in freeing the obstructed portion.

The peritoneal cavity contained an excess of thin, bloody fluid most abundant in the pelvis. The omentum lay for the most part in the right half of the abdomen. Where

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the loops of small intestine are exposed they are lightly bound to the parietal peritoneum by a thin fibrinous exudate. The small intestine is moderately distended with gas, the surfaces are covered with thin fibrinous layer of exudate. The vessels in places are injected and there are occasional small fresh hemorrhages beneath the serosa. The transverse colon is somewhat distended. The stomach extends over to the costal margin at the right mid-axillary line and completely hides the lower border of the liver.

Gastro-intestinal Tract —The stomach is negative except for post-mortem erosion. The duodenum is negative. There are no hemorrhages beneath the mucosa or serosa. It appears normal in every respect. The intestine the serosa of the small gut is covered with fibrinous exudate, and in places the exudate is fibrino-purulent. Beneath the serosa, particularly in the first part of the jejunum, one sees dark areas which are apparently hemorrhagic and which, in general, follow around the circumference of the gut. At one point 135 cm from the beginning of the jejunum, there is an enterostomy wound with the tube sutured into the gut. It was this tube that passed out through the omentum. Twenty-five cm above this tube a line of sutures in the gut runs parallel to the mesenteric attachment, and here there appears to have been an opening extending directly into the lumen (probably the perforation noted at operation). There is no change made out around this area except hemorrhages beneath the margin of the mucosa. In the first part of the jejunum the mucosa appears normal except for occasional small hemorrhages lying beneath it. As



FIG 16 —P. H. Autopsy No 9426 Low power of intestine showing larger submucous hemorrhage

one passes down the mucosa there is no exudate seen on its surface, it has rather a velvety appearance. In a few places the crests of the rugae appear injected, and this injection is particularly marked where the enterostomy tube was inserted. Here the submucosa is rather hemorrhagic, but the mucosa seems to be intact, and no exudate is made out. Extensive hemorrhage is seen beneath the mucosa about 25 cm beyond the enterostomy opening, but there is no exudate seen on this part. In the ileum there is seen beneath the serosa a narrow, hemorrhagic band about $\frac{3}{4}$ mm wide, which entirely encircles the gut. The serosa is roughened over this area, as if there had been an adhesion (this was point of obstruction). Within the gut, the mucosa directly

overlying this band has disappeared and there is a grayish exudate encircling the gut which corresponds exactly to the outline of the hemorrhagic band seen beneath cro 1. This ulceration is seen 100 cm below the enterostomy opening or 235 cm from beginning of jejunum and 200 cm from ileo-caecal valve. The vessels in the mesentery at the site where this encircling ulceration of the intestine occurs do not seem to be thrombosed. It passes through a large Peyer's plaque. The gut below this area is quite dark red in color. The mucosa is quite purplish but seems intact. The Peyer's patches and solitary follicles stand out very sharply. Just at the margin of the ileo-caecal valve is an area which appears to be slightly ulcerated but this cannot be definitely determined. This area is only about 1 cm in greatest diameter. The mesentery of the small intestine especially that portion going to the ileum is covered with fibinous exudate. There are numerous recent hemorrhages beneath the peritoneum and in the smaller veins are dark red thrombi.

THE ILIO-HYPOGASTRIC NERVE IN RELATION TO HERNIOTOMY

BY EDMUND ANDREWS, M D

OF CHICAGO, ILL

FROM THE DEPARTMENT OF SURGERY, UNIVERSITY OF ILLINOIS

THE relation of the nerves in the inguinal region to the innervation of the lower abdominal muscles has been the subject of much discussion. The importance of the matter is evident on account of the frequent lesions of one or more of them in the performance of inguinal herniotomy. The ones liable to injury are the ilio-inguinal and the ilio-hypogastric. The arrangement of these is exceedingly variable. Both arise from the first lumbar, often in a common trunk, and both generally receive fibres from the twelfth dorsal. The nerves pierce the internal oblique muscle very close together a short distance above and lateral to the inguinal canal. The ilio-inguinal becomes incorporated in the cord and emerges with it through the external ring to supply the skin of the scrotum in part together with a patch on the thigh. About this nerve there can be no question. In the inguinal canal where it is liable to injury, it is purely sensory. Its motor fibres are given off before it enters the surgical field.

The ilio-hypogastric presents a more difficult problem. Its hypogastric branch as we see it at operation runs between the internal and external oblique one or two cm. from the lower border of the former. It is generally described as lying on the internal oblique but this is not strictly correct as it is often more intimately associated with the external oblique aponeurosis, and when the two are separated the nerve often comes up with the outer layer. It pierces the aponeurosis just above the internal ring and supplies a rather variable skin area there. In cases where it has been sectioned at operation it is generally impossible to outline any area of anæsthesia, as the overlap of the twelfth dorsal and the ilio-inguinal fields is so great. Paræsthesia is more common. Anastomosis between these two nerves is free throughout their course and the relative size of the two is variable. It is not at all uncommon to find one very large and the other very minute. Often only one can be demonstrated and it runs a course very close to the lower border of the conjoined tendon.

The important question is whether any motor fibres are given off from this nerve in the inguinal canal. The anatomical texts unanimously beg the question. Judging by the anatomical arrangement and the close proximity of the ilio-hypogastric to the internal oblique the entire length of the canal, it would seem logical to assume that some of its motor fibres were given off in the canal and that section during operations would therefore cause a paralysis of its lower fibres. These, of course, are the all-important ones in

relation to the cure of hernia, and the preservation of this nerve would seem vital

Dowd¹ stimulated the nerve during the course of operations and caused contractions of the lower fibres of the external oblique. He assumed that this meant that motor fibres were given off below the point of stimulation. This, of course, was an unwarranted assumption as the possibility that the response was reflex was not considered.

Subsequently, Moschcowitz² sectioned the anterior roots to this nerve in two dogs, and after allowing time for descending degeneration to occur, killed the dogs and failed to find any signs of degeneration in the nerves in the inguinal canal. This experiment doubtless settled the matter as far as dogs were concerned, but in view of the great differences in the anatomy of the inguinal region in the dog and man, could not be said to mean much for the latter. In dogs there is no conjoined tendon. The lower fibres of the external oblique are absent and it inserts high up on the rectus sheath. The very fibres under question in man are not found in the dog.

However, I wish to report some experiments which confirm the latter view, that the nerve in the canal is purely sensory. In two cases I have stimulated both ends of a nerve which had already been accidentally sectioned at operation. Incidentally, I would like to say that injury to these nerves is most often due to the pernicious teaching of pushing a director up the canal and cutting onto it to lay the canal open. If the director slips under the nerve, as often happens, it is almost sure to be cut. In both of these cases electrical stimulation of the distal segment gave no contraction, but stimulation of the proximal segment caused violent contractions of the lowest fibres. This, of course, can only be interpreted as a reflex action.

As in each of these cases the section of the nerve had been made in the middle of the canal, the results held good for only the proximal portion. Therefore the question was put to the test in the following manner. During operation under general anaesthesia, the nerve was dissected free at the uppermost end of the canal. Here it was blocked in a short section by the injection of a little 2 per cent novocain under its sheath. Sterile electrodes were then applied just distal to the point blocked and no reaction to stimuli could be produced. If, however, the electrodes were applied proximal to the infiltrated area, stimulation produced contractions of the internal oblique fibres visible in the canal. This experiment was repeated on five individuals with seven hernias, and in all cases the results were the same.

Conclusions—The only possible interpretation of these experiments is that the ilio-hypogastric nerve is motor to the lower fibres of the internal oblique muscle, but that all the motor fibres are given off before the nerve enters the field of operation for hernia, and that, therefore, accidental section of this nerve will not cause any paralysis of this muscle.

¹ ANNALS OF SURGERY, vol LXI, p 483

² Moschcowitz ANNALS OF SURGERY, vol LXVI, p 79

MULTIPLE SACS IN INGUINAL HERNIA

BY ANDREW McQUEENEY, M D

OF BRIDGEPORT, CONN

THE area known as the fovea inguinal internus, *i e*, the portion of the inguinal region between the median line and a fold of fascia in the region of the deep epigastric vessels, is occupied by relatively more preperitoneal fat than any other region except the fatty capsule of the kidney. The preperitoneal fat in the inguinal fovea is continuous with the retro-pubic fat anterior to the bladder. This fact is of peculiar interest to the surgeon. In this region inguinal and femoral herniæ occur and the sac may be covered by this fat and be mistaken for a pad of fat. Here is found a weak, ovoid area bounded below by Cooper's ligament (*i e*, the thickened part of the pectineal fascia), externally, by the ilio-pectineal ligament, above, by the free border of the internal oblique muscle and the conjoined tendon, and internally by the arched border of the conjoined tendon (inguinal aponeurotic arch) and the lacunar (Gimbernat's) ligament. This ovoid area is divided into an upper and lower segment by the inguinal (Poupart's) ligament. This place is weaker than any other part of the abdominal wall. The chief retaining membrane is the transversalis fascia which lines the entire abdominal cavity external to the peritoneum. This fascia is normally thicker here than elsewhere.

Below Poupart's ligament at the site of the crural (femoral) ring, the layers external to the peritoneum are the transversalis, cribriform, superficial fascias and skin. Above Poupart's ligament the aponeurosis of the external oblique muscle gives added protection to the peritoneum and transversalis fascia except at the site of the external abdominal ring. In this region 79 per cent of herniæ of the abdomen occur, *viz*, indirect and direct inguinal and femoral. (See Fig 1.)

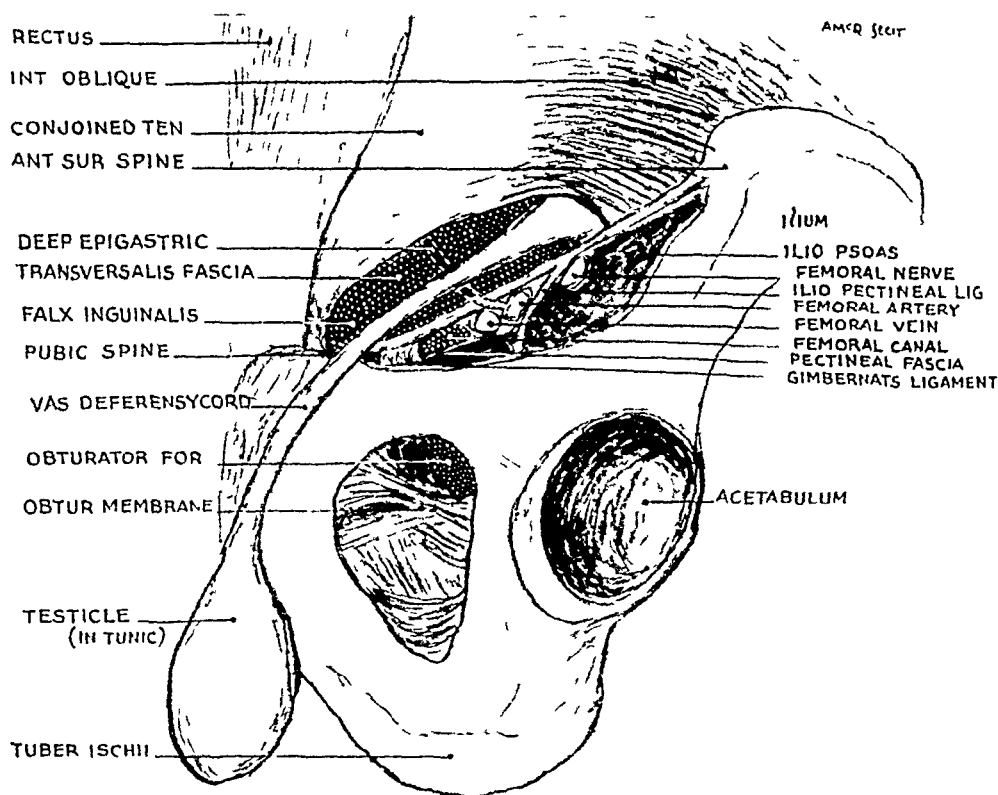
Hernial sac with fatty capsule was found to be the rule in femoral hernia, and in the majority of direct inguinal herniæ. It was frequently found in association with other hernial sacs on the same side. The finding of this type of sac frequently in so-called recurrent hernia, prompted me to the belief that more than one sac is often present, contrary to present day teaching, but, being mistaken for a pad of fat is not removed.

How many times is a second sac overlooked in the ordinary routine of inguinal hernioplasty? I do not refer to the extra lobule of the bifurcated sac in hernia as described by Hoguet. In this latter type two portions of the same sac are separated by straddling the deep epigastric vessels.

The condition to which I desire to call attention may be described thus. There is found the usual glistening sac or peritoneal protrusion entering the spermatic cord at the site of the internal abdominal ring. In addition there is found, above and external to the pubic spine a thick-walled sac composed of a thin pouch of peritoneum enveloped in a fatty capsule,

varying from $\frac{1}{16}$ to $\frac{1}{4}$ inch in thickness, which is again enveloped in a very delicate membrane derived from the preperitoneal fat

The old aphorism, "familiarity breeds contempt," is nowhere more often applicable than when dealing with hernia. No operation is more frequently considered beneath the forte of the surgeon. Yet it would seem that we have too readily accepted the classic description as given by Bassini and others and neglected to observe carefully the cases which vary from the classic types. In checking back on cases that have come to a second or third



▨ AREAS INDICATE WHERE HERNIA MAY OCCUR

FIG 1 —The hernia zone

operation one is impressed with the fact that although the primary operation was for an indirect variety of hernia, the recurrence is of the direct variety. My contention is that in most cases the two sacs were present at the time of the first operation. Because of the generally accepted teaching, the thin-walled sac was recognized and cared for and the fatty-walled sac overlooked or not recognized for its true status and simply pushed beneath the innermost sutures, which united the conjoint tendon to Poupart's ligament. In the history of these cases the patient usually says that he felt the same "strain" immediately after operation as before but that the mass did not become appreciable as an external swelling for from one to six months.

The present day argument that the recurrences are due to sewing red

MULTIPLE SACS IN INGUINAL HERNIA

muscle to white fascia and not white to white seems far-fetched. Anyone who has operated for recurrent hernia knows full well that the internal oblique, will, and does heal firmly to Poupart's ligament in the mid-portion of the inguinal canal. It is only at the inner portion above the pubic spine, where the areolar tissue is not properly cleaned from the conjoined tendon that recurrences occur. The importance of the transversalis fascia is often overlooked. I am firm in the belief, that if care is taken, to recognize and excise all sacs or peritoneal protrusions from the inguinal region, to close the rent in the transversalis fascia, and to carefully free the edges of the transversus and internal oblique muscles and tendons and Poupart's ligament of fatty tissue, that the technic of Bassini answers fully as well as any of the numerous later modifications.

Souttar¹ recently called attention to the fatty capsule about the sac in femoral hernia. I believe that careful examination of cases of inguinal hernia will reveal a large per cent with two sacs, an indirect thin-walled sac and direct fatty sac. During the past four years nine cases with multiple sacs have been noted, out of a total of 129 cases of various kinds of hernia. This is approximately 7 per cent. This per cent is about the same as is given by honest statisticians as the number of recurrences. Multiple sacs were usually found in fat individuals between thirty-five and fifty years.

Of the total number, 129, the different kinds of hernia were as follows: inguinal 95, (indirect 81 or 63 per cent, direct 14 or 10 per cent), femoral 8, or 6.2 per cent, umbilical, 11 or 8 per cent, recurrent inguinal 9 (6 direct, 3 indirect) or 6.9 per cent, abdominal 5 or 4 per cent, internal 1 or .8 per cent. There were six strangulated herniæ, four inguinal, one femoral and one umbilical. Six were congenital. The strangulated and congenital are otherwise classed according to location.

REFERENCE

¹ Souttar. British Medical Jour., May, 1924, p. 367.

DISLOCATION OF THE SHOULDER

BY JAMES H STEVENS, M D

OF BOSTON, MASS

THERE are probably few fields of surgery which have been tilled more intensively than dislocations of the humerus at the shoulder-joint. It would seem as if the last word had been said on this subject and that following the footsteps of Allis and Kocher and Stimson, there would remain few if any new ideas which could be evolved in this old subject. But like many other fields of medicine and surgery it would seem to us that the last word is still a long distance away and that perhaps by an intensive resume of these old pathological conditions, we may evolve occasionally a new idea which may be of just as much value to the profession as the pursuit of these newer theories, many of which we shall look back upon in later years with tolerant amusement. Most of the old hackneyed subjects will stand a good deal of intensive study, with equal advantage to ourselves, to the profession at large, and to the public. Is there any need for a further study of such a well-known subject as dislocation of the shoulder?

It is difficult to make a patient realize that a dislocation of a shoulder is in reality not a simple matter, and that the effect of such an injury results many times in a permanent loss of power and efficiency to the individual, which can only be reflected in our economic national life, in a loss of productivity when we multiply this individual loss by the number of accidents of this kind. Even the medical profession fails to take seriously a dislocation of the shoulder. What are the facts? Schultz, who can hardly be criticised as an investigator, collected the end results of all dislocations of the shoulder in Kutner's Clinic for five years. There was a total of 160 cases. Some of these cases never returned. Others were excluded because of the complications. There remained fifty-four cases in which there were no complications to the luxation. Late results in these fifty-four cases showed that in only seven was the joint motion free with no pain and no loss of power that was noteworthy and that even in these seven cases, there was a loss of power which was easily measured. In thirty-nine, or 75 per cent of the cases there was marked weakness of the arm so as to be noticeable, and in one-half of these, pain was a symptom. These are startling figures and mean either that the trauma is more serious than we have been taught to believe, or that there is something wrong with our treatment. I believe it to be due to a mixture of both, but principally to the fact that in the treatment of dislocation of the shoulder, we have given little consideration to the damage which has been sustained by the supraspinatus and the short posterior rotators and that we have never considered their relaxation as a requisite to their full recovery.

A muscle always has a certain amount of elasticity but it is normally within well-defined limits and these limits are comparatively narrow. A

DISLOCATION OF THE SHOULDER

muscle only recovers its full function after injury if permitted to do so in the position of relaxation. Unfortunately, Schultz does not tell us how many of these cases presented that most unfortunate feature of all, recurrent dislocation and there are few statistics to help us, but all of us who have made investigation of this subject, know that it will easily reach one-eighth of all the cases.

Classification of luxations of the shoulder seems to be pretty well established and does not show any great variety in any of our so-called accepted text-books of surgery. There are five described varieties:

- 1 Subcoracoid—the most frequent
- 2 Subclavicular—*subjudice*, we believe
- 3 Subacromial
- 4 Subspinous—very rare
- 5 Subglenoid

The subclavicular if it occurs, which is questionable, is a further forward dislocation than the subcoracoid, and is only possible with great injury. The subspinous is only a little further backward dislocation than the subacromial, but again with greater injury to soft tissue. Subglenoid is only an interrupted anterior dislocation, a half-way dislocation, as it were.

I do not deny that an intense local force would dislocate the shoulder in any direction. If it were sufficient, it could, by fracturing the acromion, produce even a superior dislocation, but such injuries are crushing injuries and the forces producing them are usually too extensive to produce a simple dislocation and this type means nearly always a tremendous crushing injury in which dislocation is secondary to a far greater injury. There is only one type of dislocation at the shoulder-joint, an inferior dislocation primarily and depending on the rotation, external or internal, an anterior or a posterior final position of the head of the humerus.

Consider the anatomy of the shoulder-joint, and the normal abduction of the arm which it is necessary to understand in order to comprehend the mechanics of shoulder dislocation, because the shoulder dislocates always in abduction. It is necessary to a proper understanding of the mechanics of the shoulder-joint, to disregard the capsule of the joint, because the capsule is a loose bag whose function is to manufacture and to retain the lubricating substance of the joint and it is extremely unlikely that it has any other function. It certainly does not hold the head of the humerus in place in any way on the glenoid cavity of the scapula, and only in one position, extreme abduction, is there even tensing of the capsular structure and this only of the inferior portion.

If one has any doubt of this fact, he has only to remove the muscular attachment from the shoulder-joint. Remove the deltoid the biceps the coraco brachialis, and the triceps muscles—all of which in the condition of normal tonus tend to hold up the arm. Still the humeral head is held into its socket on the glenoid, but divide the supraspinatus muscle and the short

The greater tuberosity of the humerus in his case comes in contact with the tip of the acromion when his arm is at 90 degrees of abduction and from this point the inferior edge of the scapula can be seen to swing outward as the acromion is pushed upward by the greater tuberosity or lifted upward by the action of the trapezius and serratus. At 130 degrees, however, the scapula ceases to move outward to any great extent, the greater tuberosity is felt to

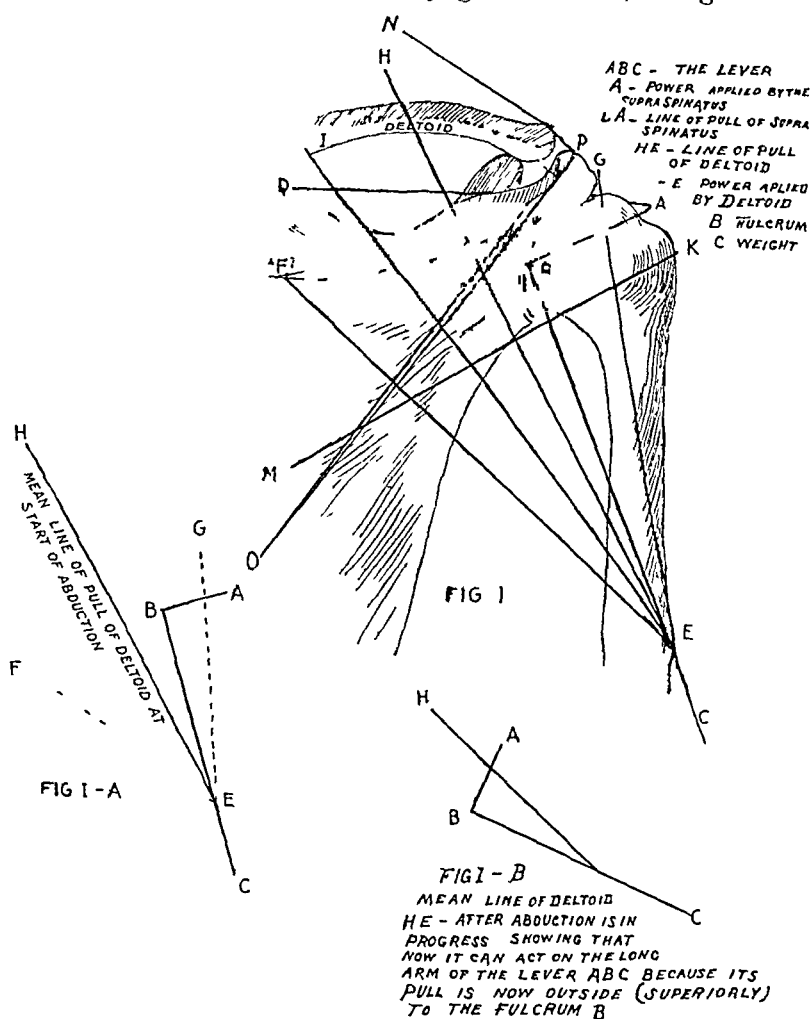


FIG 1 — Showing the lines of pull of the fibres of the deltoid providing these fibres acted together H-E being approximately the line of such pull showing that in this case it could not act on the lever A B C to abduct it. Assuming that the acromion portion of the deltoid acted as a separate muscle or as a separate contraction then it could (consider the line G-E and its effect acting at E on the long arm of the lever A-B C) aid in starting the humerus upward in abduction but should the fibres act simultaneously the line of pull would be inside the fulcrum B and provided it was in contraction it would act in opposition to the line of pull of the supraspinatus D-A. In order to act on the long arm of the lever the line H-E must fall outside the point B (fulcrum) and this is possible only after the long arm of the lever (the humerus) has been partially abducted which is done up to this point by the supraspinatus D-A acting at A on the short arm of the lever A-B C. A the power B the fulcrum, and C the weight of the arm to be abducted. K-M shows the line of pull of the short rotators causing external rotation especially pronounced once there is a fracture of the surgical neck putting out of commission the opposition of the pectoralis

major and latissimus dorsi and teres major muscles. The trapezius N-P-O is inserted into the area of the clavicle and spinous process which is shaded above the deltoid origin and if the superior fibres represented by N-P acted separately it is clearly seen that it might raise the glenoid to a higher position. This action would also be accentuated by the action of the serratus magnus which would also tilt upward the whole scapula and therefore raise the glenoid. But neither would have any influence in direct abduction except by raising this base on which the fulcrum rests. Likewise it is obvious that if the upper fibres of the trapezius were paralyzed the antagonists would tend to tilt downward the glenoid. The pectoralis minor especially would tend to do this and it would be aided by the levator anguli scapulae and the rhomboids. The lower fibres of the trapezius however are not elevators but depressors of the scapula P-O. Even with a paralyzed trapezius it must not be forgotten that much of this tendency to sag would be counteracted especially under effort by the serratus magnus muscle. With a paralyzed deltoid and a paralyzed supraspinatus if the triceps the biceps and the short rotators or enough of them were intact so as to lock the scapula and humerus together the action of the trapezius upper fibres and the serratus magnus would enable the patient to move outward the arm but it would be the first arc of abduction and not the last and it would not be a free easy abduction at the scapulo humeral joint. It would only be a swinging outward of the locked entire shoulder girdle and it would be limited. It would be analogous to the abduction which is possible with an ankylosed shoulder. Many muscles have individual action of their various parts and this applies to the trapezius and to the pectoralis major

slip under the acromion even with his hand in this position of pronation and he continues to abduct to 180 degrees. The trapezius has simply raised the acromion up in order to give more room for the rotating head and when this

is accomplished and the head is able to rotate under the acromion its further action is synchronous with that of other muscles of the scapula in the holding of the glenoid firmly in its raised position

Consider the active part of the lever, so far as abduction is concerned Figures 1 and 2 will explain much of the mechanics of active abduction Abduction is somewhat of a misnomer Do we mean abduction in pronation or abduction in supination? Abduction in pronation which is what we usually mean by the term "abduction" is in the ordinary individual due first to the action of the supraspinatus which starts the motion Then the deltoid goes

into action and continues the abduction of the arm Even with the supraspinatus paralyzed, the arc of abduction may sometimes be started, but this is done only by locking the humerus and scapula together by muscular action and using the trapezius and serratus magnus to lift up the base and to swing outward the whole locked structure

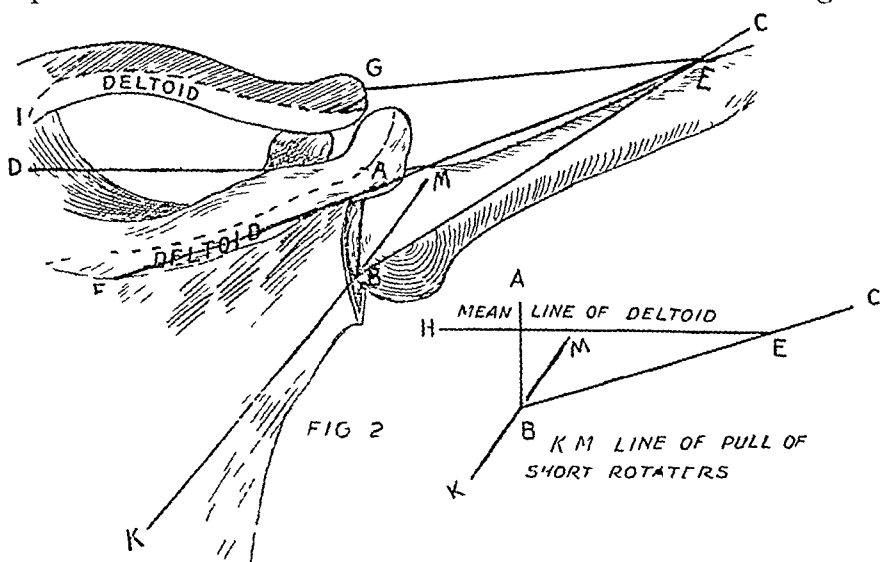


FIG 2 —This shows the lines of pull of the deltoid when the arm is partially abducted G-E F-E and I-E and the line of pull of the supraspinatus D-A acting on the short arm of the lever A-B-C while the deltoid acts on the long arm of the same lever its power being applied to E a point between the weight C and the fulcrum B Note also that both lines of pull deltoid and supraspinatus are above the fulcrum B and unless there is another force applied the fulcrum of the lever would be unstable and render worthless any amount of power applied That force I-M a line of pull of the infraspinatus and teres minor behind and of the subscapularis in front is supplied by these three short rotators without which the head of the humerus would slip upward answering the pull of the supraspinatus and deltoid Note that the line of pull of the short rotators passes through the fulcrum B therefore it acts merely as a tractor and exerts no force either on the long or short arm of the lever consequently offering no impediment to the abduction while at the same time rendering such action possible by keeping the fulcrum firmly in place

It is not the normal easy abduction of the arm from the glenoid and it is extremely limited Figure 1 shows the supraspinatus action and the deltoid action both pulling the arm upward in abduction, the tendency would be to pull the head of the humerus, so that, if this force continued without restraint the head of the humerus would be pulled up against the under surface of the acromion and there would begin to be restriction to the normal arc of abduction when the humerus had swung upward to 40 or more degrees The arm is therefore a lever with an unstable fulcrum and the bone slips and abduction is impossible A lever is only efficient if it has a fulcrum that is stable as well as a base A slip of $\frac{1}{100}$ th or $\frac{1}{1000}$ th of an inch would be as fatal to its efficiency as a greater one There must be another force or pull here at a different angle than either of the forces which we have considered, a force which will oppose this tendency to upward displacement of the abducting head of the humerus and pull it down-

ward, at the same time not impeding the rotation of the head and this force is supplied by the short posterior rotators behind and the subscapularis in front, forming a veritable sling about the head of the humerus pulling it downward away from the acromion and fixing it firmly into its place against the glenoid cavity of the scapula. Figure 2 shows the line of pull of the short rotators of the shoulder such as to hold the head of the humerus in its place on the glenoid. Inasmuch as the line of pull falls through the fulcrum, it does not obstruct the movement of the abduction in any way, and by pulling the head of the humerus firmly into place and keeping it there, it prevents

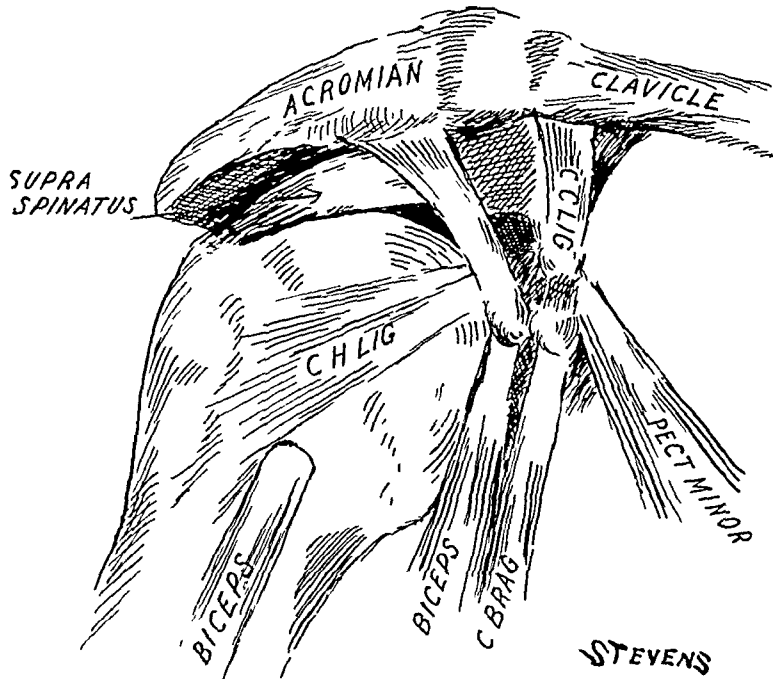


FIG. 3.—This view shows how impossible a sub-clavicular position of the dislocating head would be without other injuries greater than the dislocation. In order to reach that position the head would either have to come through between the two heads of the biceps and then ride over the coracoid or under the short head of the biceps and coracoid. The first way the subscapularis, the infraspinatus and the teres would all have to be ruptured and the coraco-acromion lig. and supraspinatus probably. If the head came out as it does under the short head of the biceps and coraco-brach either these two muscles would have to be ruptured or the coracoid process fractured in addition to the pathology stated above in order that the head should become sub-clavicular.

riding up of the head under the acromion while at the same time helping to lift the acromion and makes abduction a possibility. Remove from this lever these short rotators, either by operation or paralysis, and with the deltoid intact and the supraspinatus acting, the man will not abduct his arm beyond 45 or 50 degrees, and only then by a tremendous effort. So that this sling of elasticity, about

the neck of the humerus is of as much importance to the normal abduction of the arm as a functioning deltoid or supraspinatus muscle.

It is necessary to remember that this external rotation movement of the humerus which seems so easy to execute, is accomplished by the infraspinatus and teres minor muscles overacting as compared with the subscapularis, nevertheless, at the same time these three muscles must keep up their tension in order to keep the fulcrum of the lever, the humeral head, firmly in the glenoid. If they relax for an instant, this steady elastic pressure the lever fails, and down will go the arm to the side. A deltoid as strong as a lion's paw would only make matters worse, because a lever is only as stable as its fulcrum. (See article on action of short rotators in the *American Journal of Medical Sciences* of 1909.) This is exactly what does take place

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in these cases of a paralysis or partial paralysis from injury of the short rotators. The head of the bone rises and while the patient can abduct up to 45 or 50 degrees, then comes restriction. The short rotators paralyzed, or if not paralyzed, sometimes refusing to function because of tenderness in their injured tendons, or from tenderness in the floor of the bursal sack, which is directly above them, refuses to work. The presence of calcareous deposits in these tendons, as well as in the tendon of the supraspinatus, is usually the evidence of old injury and will be found oftener in those patients who have at some time suffered from an old dislocation at the shoulder-joint, or an old injury which has caused straining of these tendons.

In the ordinary type in abduction, in pronation, the greater tuberosity strikes against the lower side of the acromion when the arm has swung up to about 90 degrees and further motion is impossible, except as the acromion process is lifted, the entire scapula rotating outward. The trapezius which is the shrug-

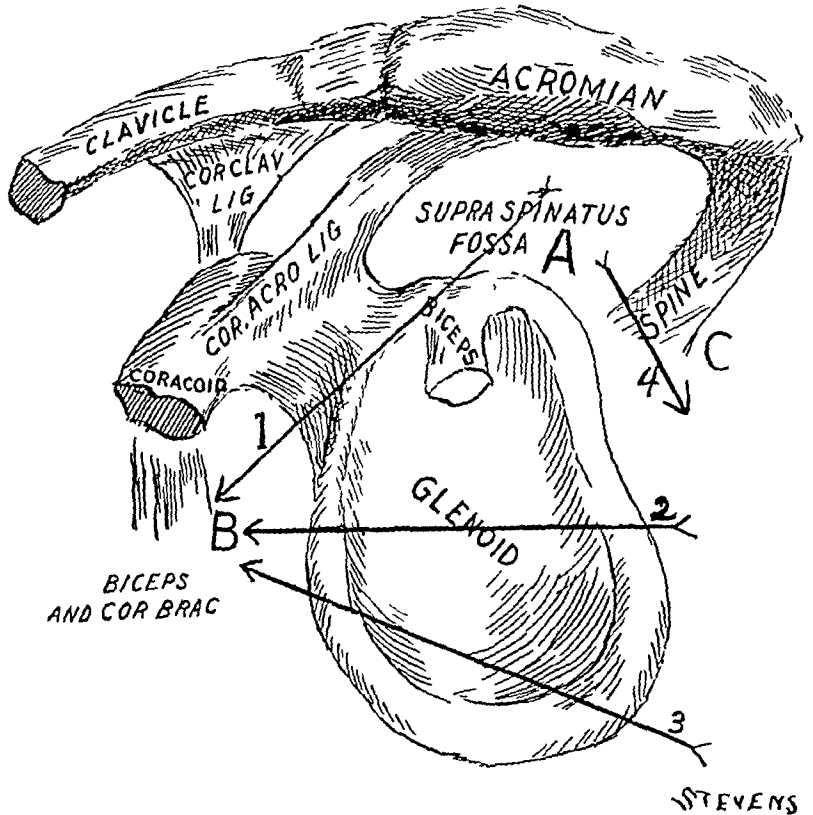


FIG 4.—Shows by arrow 1 the increase of distance the supraspinatus would traverse if dislocated anteriorly under the coracoid, and how impossible it would be without rupture of this tendon and many others to further dislocate the head of the humerus under the clavicle. Arrows 2 and 3 show the greater distance which would have to be traversed by the infraspinatus and teres minor in order that the anterior dislocation should be possible. The tendons would be under great strain across the empty glenoid. Impossible for the head to go further anterior under the clavicle without rupture and also a broken coracoid or ruptured biceps and coraco brachialis. Even then the subscapularis would prevent it. Arrow 4 shows shorter distance of supraspinatus to its new position at C in posterior type of dislocation.

ging muscle of the shoulder, rotates the scapula and lifts it up in order to increase the ability of the head of the humerus to rotate under the acromion. The serratus and the short rotators aid in this same movement and the clavicle rises also. They fix the scapula firmly in this raised position and thus being the base of the lever, permits the degrees of abduction between 90 and 130 degrees, while they do not actually abduct. Here again comes restriction. There is restriction because the greater tuberosity still impinges upon the tip of the acromion process and the acromion has been tilted to its limit. Further motion is impossible. Now by externally rotating the humeral head so that the hand is in supination, the groove in the humerus between the greater and lesser tuberosities comes into line with the tip of the acromion

and there is just clearance enough to permit further abduction as the greater tuberosity rotates under the acromion, and in both types when the tuberosity rotates under the acromion the scapula ceases to turn outward to any great extent. The clavicle ceases to rise at this point, which it would not do if this further action were due to the trapezius. The further swing of the inferior tip of the scapula is less pronounced and what little there is, is decidedly forward instead of directly out. In some cases the turning is nil, once this point has been reached.

The muscles which accomplish the last arc of abduction especially with

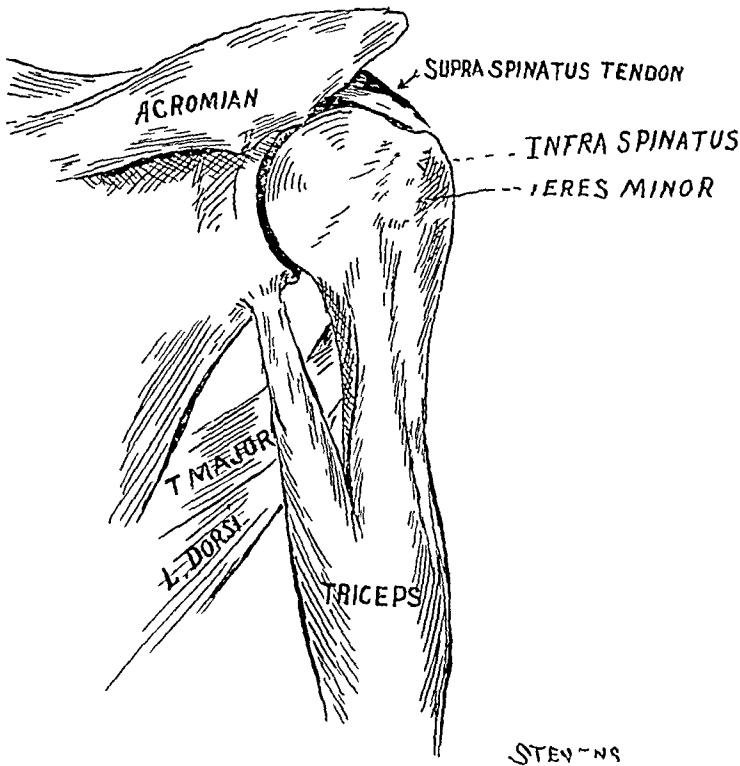


FIG 5 —This figure shows the lessened strain both on the supraspinatus and infraspinatus and teres tendons which would result once a posterior dislocation had occurred. The strain in this form of dislocation obviously would fall upon the subscapularis tendon in front except for the immediate strain thrown upon the supraspinatus at the time of dislocation. This figure also shows the well protected surface of the joint from behind if we reconstruct visually the infraspinatus and teres minor

the hand in the position of supination, which is necessary for the completion of abduction in the vast majority of cases, are the deltoid the biceps, the pectoralis major, and the triceps. How can it be otherwise? The biceps runs across two joint surfaces and therefore it flexes both. The triceps runs across one movable surface and by its action it keeps the forearm in a fixed position, therefore making a fixed point upon which the biceps can exert its action, without flexing the forearm, in this way

transferring all its action to the shoulder. This action is, however, limited.

The pectoralis major runs across the upper joint and the clavicular portion innervated from the fifth cervical root, becomes an abductor of the humerus after the arm has swung beyond the horizontal. After the arm has swung upward to 130 degrees if one will note its strength of contraction, he will conclude that it is a tremendous abductor, and it constitutes, together with the deltoid which is still able to function, after the tuberosity has rotated under the tip of the acromion or after the tip of the acromion has been lifted and rotated out of the way by the trapezius and serratus, the main power in abduction in its final arc.

The trapezius and the serratus magnus from now on are only fixers.

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stabilizers of the scapula, but they have a very limited action except between 90 and 130 degrees so far as abduction of the arm is concerned. Almost as much can be said for all the other muscles attached to the scapula but nevertheless they are not to be termed abductors.

A dislocation of the shoulder anteriorly, that is, a primary dislocation of the shoulder, without first being an inferior dislocation, is an impossibility except perhaps as we have said, rarely as the result of an extreme local force in which the dislocation would be secondary to a tremendous crushing and tearing lesion. The same objection applies to a posterior dislocation. There is no such thing except as applies also to the anterior in the face of an overwhelming local crushing force. The rent in the capsule usually runs up as high as the coracohumeral ligament, which runs across anteriorly from the coracoid process to the humeral head, and is in reality a thickening of the capsule. The capsule is always torn away from the glenoid rim and never from the humeral head. Why? Because the head of the bone in the position

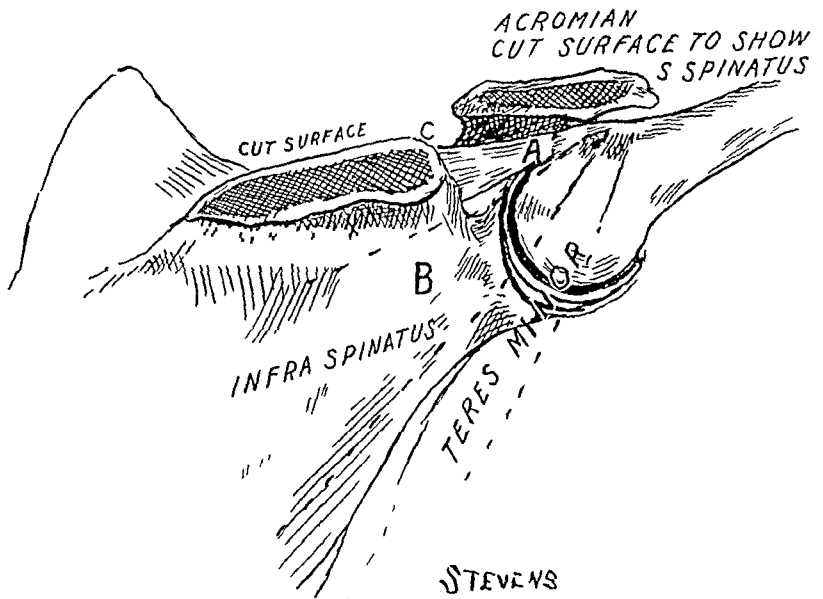


FIG. 6.—The acromion has been cut so as to show the insertion of the supraspinatus from behind. Note how well protected the posterior surface of the joint would be by the tendons of the infraspinatus and teres minor. This drawing also shows how these three muscles keep the head of the humerus against the glenoid at the same time allowing abduction. In a posterior dislocation note that the distance from C to A normal position would not be increased if A were transposed to B the position of posterior dislocation while the infraspinatus and teres minor would be relaxed.

of abduction is tensing the inferior portion of the capsule, and as external rotation comes, the head of the humerus brings local pressure to bear against a comparatively weak structure. This is the only portion of the capsule which is tensed under any condition and the direct pressure of the dislocating head is exerting local pressure against it. Were it a very strong membrane, it might tear anywhere but not so with a comparatively slight structure.

The normal abduction of the arm with the hand in pronation and with the arm in internal rotation, which is the position which one assumes when one falls, proceeds up to a certain point with ease, until well above a right angle where it is arrested. The greater tuberosity of the humerus goes bang up against the outer projection of the acromion process of the scapula. The scapula is forced upward by this force, but this upward motion is limited. If the force continues, the greater tuberosity is broken, the neck of the humerus is broken off, which rarely happens, the tip of the acromion breaks

If a man fell with his arm in this position, the hand in supination, his humerus would go smash up against his head and he would not break his shoulder and he would not dislocate his arm, but he does not fall like that. One falls with hand in pronation and arm in internal rotation, in order to save himself, and so the greater tuberosity impinges on the acromion process. The reason that a greater number of breaks of this type do not occur is this additional lifting of the scapula on the clavicular sternal and acromio-clavi-

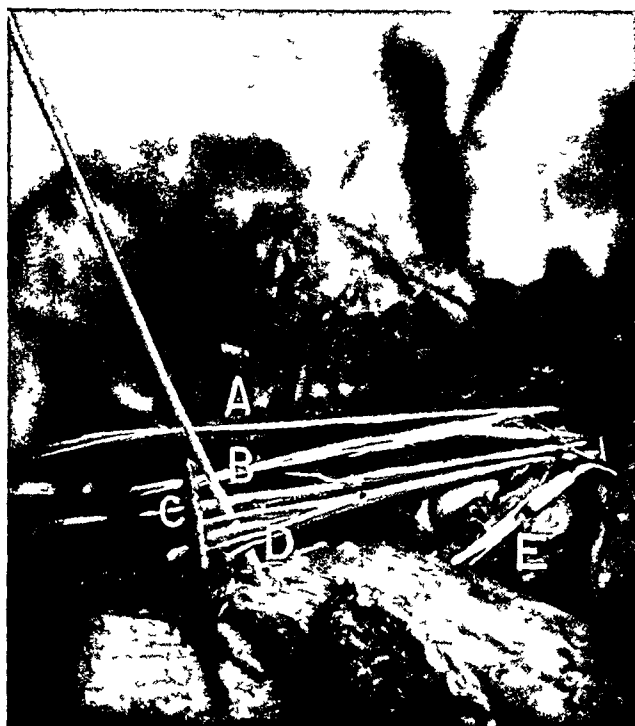


FIG 7—Shows dislocating head of humerus just coming through the capsule in anterior dislocation. Note the circumflex nerve directly over the head in this position of abduction of the arm. Is it any wonder that paralysis of deltoid follows so frequently? Note that this nerve and to a lesser extent the musculospiral are more fixed in position because both pass under muscular structure and through layers of restricting fascia which binds them down so that a stretching is more serious than in the others. In the order of their fixity these nerves are the circumflex, the musculospiral and the musculocutaneous and therefore these three are more likely to be injured by strain. In the position of abduction the musculocutaneous is superior and therefore above the major strain imposed by a dislocating head in most cases. The head of the humerus has come out in some cases even between the two heads of the median. Visualize in such a case what a leverage reduction might do.

partly rotated under the acromion the leverage is transferred to the neck of the humerus and often results in a fracture of the neck of our Type II class. See "Fracture of the Upper End of the Humerus" *ANNALS OF SURGERY*, 1919.

The supraspinatus muscle is not tense but is relaxed and the head of the humerus slides downward and the inferior portion of the capsule is tensed. Even now the head of the humerus would not dislocate even if the capsule tore in the majority of cases. But just at this instant when the head of the humerus is forced downward to rest on the inferior rim of the glenoid,

clavicular joints to the limit of elasticity permitted by the muscular attachments of the rhomboids, the pectoralis minor, the levator anguli scapulae and the rhomboid ligament the action being of the same nature as the recoil mechanism of a gun.

If all these structures hold and there is no break or even if the break in the greater tuberosity which frequently happens, is not enough to release the pressure, the force continues. The pressure of the tip of the acromion is trying to push the humerus into external rotation and release it. If this were a slow process, it would accomplish its task. It also acts now to force the head of the humerus not only downward, but to lift it out of the glenoid cavity because for this stress a new lever with its fulcrum on the tip of the acromion, is established and where the head has

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literally lifted on to the glenoid rim, comes the movement of external rotation, not half-way, but extreme external rotation, and the head is twisted out of the glenoid and through the inferior torn portion of the capsule. If you have ever externally rotated an arm from which the pectoralis major muscle has been removed, you will be impressed at the way in which the head of the humerus will rotate to the front of the glenoid and become prominent. Once the head of the bone has slipped out of the inferior rim of the glenoid, the future position of the head depends entirely upon the position of the arm as regards rotation. If in external rotation, which is the position which all the forces tend to produce nine times out of ten, the force of the acromion pushing on the greater tuberosity, or on the neck if the tuberosity has succeeded in slipping under, the force against the elbow and forearm externally as the man falls on his side, as he does naturally, all tend to further externally rotate the humerus.



FIG 8—This represents a type of fracture which is fairly common with dislocation of the shoulder. It is an impact separation of the greater tuberosity, and is not due to the same mechanics as that represented by Fig 9, which is a periosteal tear from tension on the tendon. These two types are the most common complication in injury from dislocation.

Result, a humerus whose position in abduction and leverage against the acromion, the arm being in internal rotation has withstood the hammer blow against the process without fracture of the greater tuberosity and without fracture of the neck of the humerus. It has been forced downward on the glenoid and by force of leverage against the head by the acromion the gliding surface of the bone has been lifted as well as forced downward on to the glenoid rim. External rotation, normal external rotation which would have permitted the normal depression in the humeral head between the greater and lesser tuberosity to come into line with the tip of the acromion process and so have permitted hyper-abduction and freedom of motion, thus releasing the pressure, has failed to materialize in time and then too late has come with extreme force. It is the last straw and out goes the head of the bone and the resulting dislocation is a subcoracoid dislocation of the humerus. If exactly

at the moment when the head of the humerus is on the inferior rim of the glenoid, there is the unusual force of extreme internal instead of external rotation added the resulting twist inward of the head of the humerus will have a tendency to force the articular surface backward and there will result either a subglenoid, in which the force of internal rotation has been small and only enough to counteract the tendency for the head of the bone to slip forward under the coracoid, or a still later type, a sub-acromial dislocation



FIG 9—This shows a type of lesion as common to dislocation as the type showing a definite separation of the greater tuberosity. The mechanics are different however. This represents a periosteal tear of the insertion of the supraspinatus and is caused by the strain on this tendon usually at the time of dislocation. Undoubtedly, in a leverage reduction it might also occur but it usually takes place at the time of dislocation and is more common in the anterior types

A dislocation of the shoulder anteriorly, especially, is an impossibility without putting a strain upon the tendons of the supraspinatus, the infraspinatus, and the teres minor. If the dislocation is the subcoracoid one, which is the most common form, the distance from the origin of the supraspinatus to the new position of the greater tuberosity of the humerus under the coracoid is clearly greater in distance than in the normal position, and the tendon of the supraspinatus is also angled over the rim of the empty glenoid. See Figs 3 and 4. Codman reported a number of cases of rupture of the supraspinatus tendon from being caught between the greater tuberosity and the acromion and while at the time we accepted that explanation, we have

become more and more convinced that the supraspinatus is rarely or never caught between these bony prominences, but that it is the force producing a dislocation that causes rupture of this tendon. That is a rupture of the tendon *per se*, or a periosteal tear and not a separation of its insertion into the greater tuberosity by a fracture which occurs frequently from impact on the acromion process as I have shown in a recent article (ANNALS OF SURGERY of 1919) (Fractures of the upper end of the humerus). We may, I think, assume that in every case of dislocation of the humerus and especially in anterior dis-

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location, there is injury to the tendon of the supraspinatus, and that often it is ruptured. If the dislocation is further forward, a so-called subclavicular dislocation, if such exists, it is always ruptured. Otherwise, it would be impossible to put the head of the humerus in this position.

The infraspinatus and teres minor muscles are posterior and run outward from the posterior surface of the scapula to be inserted into the greater tuberosity of the humerus to complete with the anterior muscle, the subscapularis, the sling about the head of the bone which under tension makes it possible for the deltoid to abduct the arm. We have shown that if these are paralyzed or if they are injured

or do not work smoothly the deltoid can only abduct the arm with difficulty and often not at all. Forty-five to fifty degrees of motion is possible and then restriction. Not from pain, not from any inability of the deltoid to do its work, but simply and solely because these short rotators refuse to work. The sling about the head of the humerus is not efficient and the head is not held firmly against the cavity. The same phenomenon will take place when a subscapularis tendon refuses to work, thus destroying the sling anteriorly, but injury to the subscapularis, except as a part of a brachial plexus paralysis is not so common as an injury to the posterior short rotators. In one case of ours,

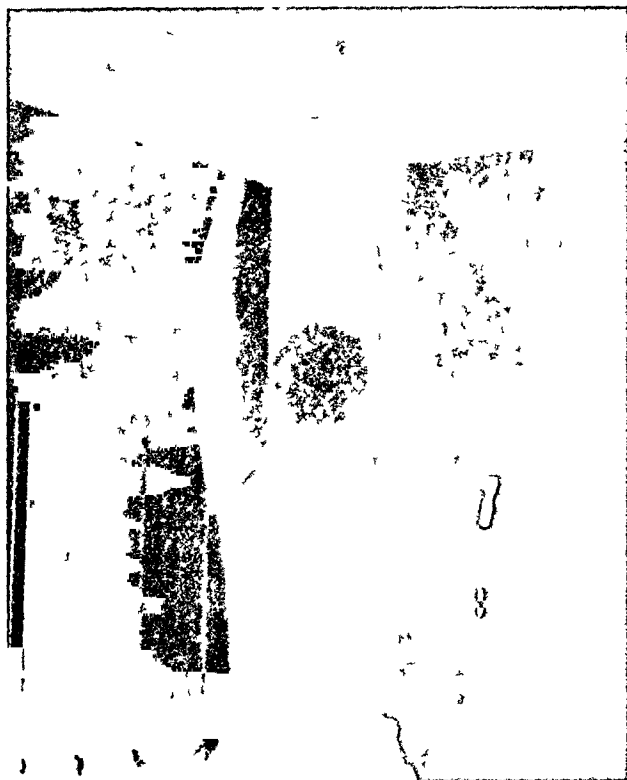


FIG. 10.—Shows abduction in pronation. This type can abduct in this position to the side of the head. The outer end of the clavicle ceases to be raised, however, when 130 to 135 degrees has been reached. If the final arc beyond 135 degrees were due to trapezius action this would not be so.

following an injury, not a dislocation, there was a paralysis of the subscapularis muscle, as a part of a paralysis which involved the latissimus dorsi, the pectoralis major, and minor tendons. The trapezius and the serratus were intact. The arm was externally rotated, therefore the infraspinatus and the teres minor were intact. The arc of abduction could be started, therefore the supraspinatus was intact. The deltoid took up its work and the arm could be abducted by strenuous effort, fifty to sixty degrees, but the weight of a finger placed upon it would send it down and beyond this it would not go.

Here we have identically the same result as before, the sling about the head of the humerus which is necessary to abduction, is out of commission. But this is rather unusual. In these cases of dislocation anteriorly, it is the posterior rotators which are injured exactly as the supraspinatus is injured and oftentimes they are ruptured. The distance from their origin to their

insertion on the greater tuberosity of the humerus in the position of sub coracoid dislocation, is much greater than normal and these tendons are pulled straight over the posterior rim and inferior edge of the glenoid. They are tense and they are always injured, sometimes more and sometimes less and reacting to injury even if not entirely ruptured, they are inflamed and never again are they exactly the same smooth resilient tendons which they were before.

Any substance which is elastic or expansile and that has suffered a strain which is greater than its tensile strength is never fully recovered from. This applies to rubber or to steel or to iron or to muscle. It is one of the underlying principles of mechanics. In these anterior dislocations, the subscapularis is not tensed. If anything it is relaxed. Leave the head of the bone out for a short time and you will have a tense subscapularis from contraction, so tense in old cases as to require division before reduction can be accomplished, but not in fresh cases. In a subcoracoid dislocation, the short head of the biceps and the tendon of the coraco-brachialis are pushed forward over the head and tensed also. The long head of the biceps is usually lax across the joint and there is plenty of play so that usually it is not ruptured. In these mild cases the head of the humerus is hardly off the glenoid anteriorly.

Anything which relaxes the biceps and coraco-brachialis and gives the bone a push upward and posteriorly is enough to reduce it. What we actually do by Kocher's method of reduction is to relax the biceps and coraco-brachialis and by external rotation to use the posterior side of the greater tuberosity against the anterior rim of the glenoid to lift the head and then by carrying the arm across the front of the chest keeping the pivoting leverage of external rotation, we also lever it against the coracoid and the head of the bone slips up on the glenoid rim. It is a double leverage and a lift and not as has been said by using the posterior portion of the capsule wound about the head and neck to draw it into place. How by externally rotating the head of the bone, the small amount which one does, can you wind the posterior capsule about the neck of the humerus? What you do by external rotation is to produce exactly the position of the capsule as when the accident happened, and if the bone came out of the capsule in that position, it can equally well go back if you reproduce the same condition backwards. If anything you will unroll the posterior portion of the capsule instead of tensing it and this is exactly what you wish to do, and a little push upward and backward at the same moment that you swing the arm across the chest will help you tremendously after the capsule is unrolled and the rent made bigger. The worst thing that can be said about it is that it is reduction by leverage, the force being applied on the long arm of a lever of the first class, power, fulcrum, weight and a tremendous leverage is obtained which improperly used can also do a tremendous amount of damage. If you properly interpret the condition, the greater tuberosity being against the anterior rim of the glenoid, where it can be used to lift the head by external rotation of the arm.

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you will succeed. If anything interferes and the head does not rise to the glenoid, you may tear your muscles more and you may even fracture the humerus or the coracoid thus creating greater trouble than you are trying to correct. If the head has pushed further along under the coracoid you will usually not reduce it by this method. Because the head of the humerus is too far away from the glenoid, and you cannot use the greater tuberosity against the glenoid rim as a fulcrum for your lever and it is wedged. Besides in these cases, the muscular attachments, the supraspinatus, the infraspinatus and teres minor, are many times ruptured and they do not help as a fixed point against which resistance can be applied. The posterior capsule may be torn less in these anterior cases than in the posterior, but the reason that the head of the bone goes round and round as described by various writers is that it is too far away from the rim of the glenoid and there is rupture of these tendons, especially the supraspinatus and the infraspinatus and teres. The answer is abduction after flexion of the forearm to relax the biceps and coraco-brachialis and allow the head to slip back under these muscles which may hold it. First flexion, second abduction, because the arm went out in abduction, third, traction to pull it outward, fourth, external rotation to increase the hole in the capsule, this was the way it happened and if it went out that way, it can go back that way. Lastly, external rotation and traction having pulled it back to the rim of the glenoid, traction being kept up all the time, with one hand over the neck of the scapula and the fingers under the neck of the humerus, lift the humerus as the arm is swept downward across the front of the chest, external rotation thus being changed into internal rotation and the bone will traverse the same pathway which it followed in producing the injury but exactly reversed.

By flexion, we relax the muscles over the head. By traction in abduction we lift the head from under the coracoid. The subscapularis is already relaxed and we get the posterior edge of the gliding surface up to and on to the rim of the glenoid. By external rotation we relax the infraspinatus and teres minor and increase the size of the rent in the capsule. By local pressure upward and backward with the hand, we help the head of the bone over the rim and by changing into internal rotation, we tense the infraspinatus and teres when not ruptured just at the moment when we need their action to pull the head backward. If they are ruptured nevertheless we lift the head into place and internal rotation carries the head backward toward the posterior surface of the glenoid, just as external rotation has a tendency to bring it towards the anterior position.

In the subclavicular form, if such a form really exists (I have never seen one) the injury must be much greater in extent. If the head of the humerus comes out of the glenoid and comes to rest under the short head of the biceps and coraco-brachialis as it does in all the cases that I have seen, then in order to become subclavicular it can only do so by rupture of the short head of the biceps and the coraco-brachialis or fracture of the coracoid. The

pectoralis minor is also in the way and a tremendous tearing of all these structures or their rupture is necessary in order to place the head of the humerus in any subclavicular position. Assuming that the head was anterior to the short head of the biceps and had come through between the two bicipital heads, as it would have to do to be in that relation, it would nevertheless be impossible to reach a position under the clavicle without tremendous tearing of muscles and tendons. The supraspinatus in most of these cases would have to be torn, the infraspinatus and teres minor always, and the subscapularis also and an injury of this nature is rather difficult to imagine. I prefer to think that it is at least a very rare form, if it exists at all, which I doubt. At any rate, if such a position does occasionally happen the only efficient reduction would be by abduction and traction as the first part of the procedure. Try it on the skeleton and visualize the damage to the soft parts. It cannot reach the subclavicular position above the coracoid without the fracture of that process and the subscapularis would prevent its going far in that direction even if the coracoid were broken, and the posterior short rotators ruptured. It cannot reach that position from under the coracoid and the tendons of the coraco-brachialis and short head of the biceps except by fracturing the coracoid or rupturing these tendons. If any man has a plate representing such a dislocation I should like to see it.

Posterior Dislocation, Subspinous, Subacromial—The capsule is apt to be torn more than in the anterior type. It has been said that the infraspinatus and teres minor are often torn but fortunately this is not as true for posterior as for anterior dislocation. Posterior dislocations are simply a variation of the inferior dislocation due to the sudden strain of internal rotation thrown upon the humerus at the moment when the head of the bone is sliding over the inferior rim of the glenoid fossa. The arm is in abduction exactly as it is in anterior dislocation. Up to the moment of actual dislocation the movement is as we have said, abduction, a slipping down of the head on the glenoid, aided by the prying of the greater tuberosity against the acromion, then comes internal rotation instead of external rotation, as in anterior dislocation and the head of the bone goes out and comes to rest posteriorly. The supraspinatus tendon is necessarily stretched as the head slips down and out of the glenoid exactly as it is in the anterior type, but after it has posteriorly dislocated, the distance to its new position is hardly greater than in the normal position. By referring to Fig 6, the normal position of the insertion of the supraspinatus at A, would hardly be much increased if changed to the dislocated position at B, and the only injury which the tendon would sustain would be at the moment of its dislocation, or a damage to its insertion on the greater tuberosity of the humerus by the impact of abduction against the acromion. This very often happens, the greater tuberosity being split loose together with the insertion of the supraspinatus the infraspinatus and the teres minor. The danger of damage to the tendons of the infraspinatus and teres minor is much less in posterior dislocations, as can be readily seen from

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a glance at Figs 5 and 6 The subscapularis may suffer, however, since it is put on the stretch more in the posterior form and if so, we have exactly the same condition of injury to the humeral sling as we had in the anterior form from damage to the posterior rotators, but there is a greater tendency for this muscle to slip under the glenoid, thus saving itself from a certain amount of strain, stressed often, but seldom ruptured The further out the head of the humerus is under the spine the greater the likelihood of rupture of tendons

The reduction of this type is by a reversal of the methods by which the dislocation happened Flexion of the forearm is, however, not so important as in the anterior type because the biceps and coraco-brachialis are not tensed The important movements are abduction, traction, internal rotation to widen the rent in the capsule, and lastly when the head of the bone has risen to the glenoid rim, local lifting and external rotation and bringing the arm down to the side

Stimson's position of a hanging arm with ten pounds attached to the wrist, accomplishes this reduction in much the same way, both for anterior and posterior dislocation, but he does not flex the arm which is a distinct advantage He does not advocate the rotation, and rotation is a distinct advantage which can easily be added to his method, and it then becomes a reduction, practically the same as we use hang the weight on the flexed elbow and not on the wrist

Now we have reduced our dislocation, whether anterior or posterior, and what do we do? We put the arm into internal rotation We put on a sling and a swathe at least, but always in internal rotation The patient has only suffered a dislocation of the arm It has been reduced He can see no reason for being in bed and he insists on going about If the damage has been little he comes out fairly well, with from ten to twenty days of restriction of motion depending upon the surgeon who treats him, but full recovery is many times not attained and recurrent dislocation is common Much of this subsequent trouble is due in our opinion to the position in which one treats these primary dislocations of the shoulder after reduction Internal rotation twists the head of the bone inward and keeps on stretch the already overstretched infraspinatus and teres, and keeps them apart if they are actually ruptured The position of the arm at the side allows the full weight of the arm, and it is no inconsiderable weight, to fall, not alone upon the deltoid, but upon the supraspinatus muscle, already overstretched and perhaps ruptured If ruptured, the head of the bone falls away from the acromion as can be demonstrated by the X-ray if taken in the standing position, and the healing of the damaged muscle or tendon, like healing of the damaged muscles or tendons of the infraspinatus and teres minor is permitted to go on in this position of overstretch If they are simply overstretched, a good deal of recovery is certain The result is that in most cases, these muscles never fully recover their tone Their tendons never fully recover that smooth action

which is theirs from the normal elasticity of uninjured muscle fibre. There are oftentimes deposits from an inflammatory reaction in the tendons under the bursa, there is scar tissue which prevents smooth action, there is an instability of the shoulder and a tendency to recurrence of the dislocation, simply because these muscles have healed in an overstretched position and the weight of the arm never allows them to recover their normal tonus again.

Scar tissue never has the resilience of normal tissue. All these cases of dislocation of the shoulder anteriorly should be treated by abduction and external rotation for a period of not less than ten days and often more, and then gentle passive and active motion, and if so treated we shall see the passing of this tremendous number who develop recurrent dislocation.

In the case of the posterior dislocations, external rotation is not of so great an importance as in the cases of anterior dislocation, because the posterior short rotators are much less apt to be injured, but the supraspinatus is injured in both. The position of abduction not only relaxes these muscles, but it permits of the drainage of the joint itself through the rent in the capsule, and this joint is always traumatized and full of fluid. By the raising of the arm in abduction, and rotation, the capsule itself is straightened out as it were, and by gentle passive motion through a few degrees of arc only in these first days, the joint empties itself of the products of this inflammation through the capsular rent into the surrounding tissue where its absorption is more likely than when confined within the capsule. Synovial membrane is never an absorbing membrane. The edges of the torn capsule in this position are brought together without infolding and repair is rapid. Ten days in this position, or in some cases of exceptionally severe injury longer, and after that a sling to lift the elbow up and prevent sagging by the weight of the arm upon these injured muscles. Recurrent dislocations at the shoulder-joint are due always to more or less tearing of the supraspinatus, the infraspinatus and teres minor and more rarely of the subscapularis and their subsequent repair by scar tissue in the position of stretch. Dropping of the head of the humerus is due always to extensive injury of the supraspinatus muscle and not to the deltoid injury. The deltoid, while a very strong muscle is of long muscle fibre, and muscle fibre of itself will stretch under weight. The long head of the biceps where it crosses the capsule is not tense save under contraction. It is remarkably loose and that is the reason that it is not more frequently ruptured either in dislocation or fracture of the neck of the humerus, although we have seen this rupture of the long head of the biceps several times in both varieties of injury. Were these muscles together with the triceps behind responsible for the position of the head of the humerus in the glenoid, then the head of this bone except when these muscles were tense would always slip down from its normal position under the acromion. It is the shorter more fibrous and shorter bellied supraspinatus and the short rotators, aided by atmospheric pressure, which prevents this drop and a paralysis of the suprascapular nerve, without paralysis of the

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deltoid, will show this dropping nearly always. Reefing the capsule of the shoulder-joint to prevent recurrent dislocation is illogical. Reefing the tendons of the supraspinatus and the tendons of the infraspinatus and teres minor is the logical procedure for recurrent dislocation at the shoulder-joint.

Rarely, the subscapularis will also have to be tensed, but not often. Gentle passive motion, through a few degrees of arc while the arm is in the abducted position, during the first ten days, following a dislocation, and then bringing the arm to the side with restriction and freedom from weight with gentle passive and active motion to the shoulder-joint for ten days longer will do away with the greater number of these recurrent dislocations of the shoulder-joint and will give us results which will not present Schultz's terrible statistical figures.

ARTHRODESIS OF THE ELBOW *

By ASTLEY P C ASHHURST, M D

OF PHILADELPHIA, PA

ARTHRODESIS, or the production of ankylosis in a joint, is frequently employed in the tarsus, occasionally in the shoulder, wrist, hip or knee, but is very seldom indicated in the elbow

In most instances it is adopted at the locations first named to overcome disability resulting from flail joints due to infantile paralysis. The elbow-joint is seldom rendered so utterly useless by infantile paralysis that arthrodesis is required to improve the function of the limb, in almost all cases enough power will be regained in the flexor muscles to enable the patient to control the joint, even if considerable weakness persists. If the flexor muscles of the elbow remain powerless, the muscles arising from the external condyle may have their origin shifted by operation to a higher point on the humerus, and thus obtain enough leverage to render them efficient as flexors of the elbow. Indeed, in their normal position these muscles especially the brachioradialis, may act efficiently as flexors of the elbow, as I had occasion to observe some years ago in a patient with accidental (operative) section of the musculocutaneous nerve which paralyzed the biceps, coraco-brachialis and brachialis anticus (though the brachialis occasionally receives a filament from the radial nerve). In this patient flexion of the elbow was active, though weak, from the very time of operation, and no other disability was noted during the interval of a few months until regeneration of the sutured nerve occurred. But in a paralytic patient with power absent also in the forearm, and only very weak power in the fingers, the resource of muscle transfer is not available, and it becomes necessary to adopt some other method to keep the elbow flexed and bring the feeble hand into a position where it will be of some use. Of course a sling or a brace can be constantly worn, holding the elbow at a right angle, but as a rule a patient will not be satisfied to be condemned to the employment of such apparatus through life, and some operative means of relief will be sought. It was, I believe, for such cases as these that Sir Robert Jones advocated an operation known by his name and which consists in excising a large ellipse of skin from the flexure of the elbow, and suturing its edges together after flexing the forearm acutely on the arm. It may be that in some cases this will act as a temporary expedient to relieve strain on the flexor muscles of the elbow, and that the latter will recover their power before the force of gravity overcomes the pull upward

* Read before the Philadelphia Academy of Surgery, October 5, 1925

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of the skin plastic. But in such cases a sling or a brace will be as efficient a temporary prosthesis as the plastic operation, and I had never employed the operation of Jones until encountering the second patient whose history will be detailed, in whom the paralysis seemed permanent. It was a great disappointment to find that the elbow flexion secured by Jones's operation was not also permanent, but that it was overcome, gradually but surely in the course of a few months, by the mere force of gravity.

There is another class of cases in which the flail elbow is due not so



FIG. 1.—Case I. Skiagraph made seven months after operation showing bony ankylosis

much to paralysis as to excessive destruction of bone. Such cases are seen in military but not often in civil life. It was not until after I had made an arthrodesis at the elbow of the first patient whose history is narrated below, that I found (August, 1923) the following very unfavorable account given of the procedure which I had employed, and which proved perfectly successful in my hands. W. Meicer in the *Lancet* of April 21, 1923 (vol cciv, p 796), writes as follows: "Previous to the operation I am about to describe I have not seen a successful result from arthrodesis (of the elbow), the elbow is admittedly not an easy joint to deal with, but I am sure that most of the bad results are due to badly planned operations. The adjoining surfaces of radius and ulna have been bared in wedge-shaped fashion and the humerus similarly

bared and wedged between the ends of the forearm bones. Even with wiring no stability resulted from this union, ankylosis must have been very rare and had never occurred in any case I saw. Having little faith in this operation, I never performed it." He then reports two cases, both patients securing good function, in which ankylosis was procured by the following method: the atrophic end of the humerus was cut off and the healthy bone above was filed into a square shape. With a fine small frame saw a square slot of the same size was cut in the upper end of the radius and ulna (which usually,

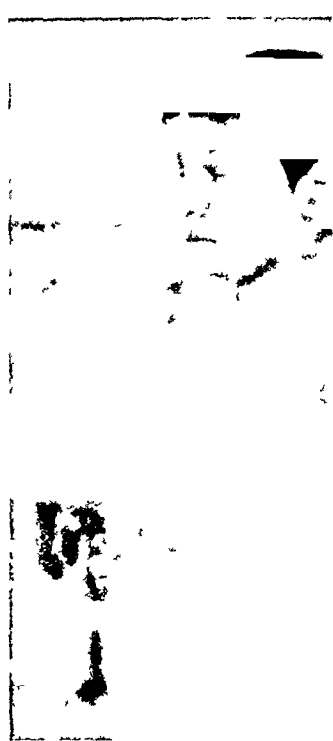


FIG. 2—Case II. Plastic operation on elbow to maintain flexion for infantile paralysis.

-- he says, are ankylosed at their upper ends). He then implanted the humerus into the slot and held the bones in apposition by silver wire passed through a drill hole. A gypsum case, including chest and arm, was worn for three months and a small gypsum case for six weeks longer, and then a sling.

In the first patient I am about to report there was not only marked atrophy of the bones the consequence of tuberculous disease originating twenty-six years before followed by an arthroplasty, and then by two excisions of the elbow, but there was in addition paralysis of the ulnar nerve (from operative section), and almost complete paralysis of the median and musculo-spiral nerves from stretching across the gap between the humerus and forearm bones.

In the second patient as a consequence of infantile paralysis, there was no power in the entire upper extremity except feeble flexion of the index and middle fingers. In each case a different method of operation was adopted, to suit the individual requirements, but, in both raw bony surfaces were kept in close apposition by wire sutures, and prolonged immobilization was employed after operation. Both patients secured bony ankylosis, and considerable improvement in usefulness of the hand.

CASE I—Margaret H. then twenty-eight years of age was referred to my service at the Episcopal Hospital in October 1915, by Dr. Charles H. Frazier. When ten years of age she had developed tuberculosis of the left elbow, and three operations for drainage had been done at various times, the patient finally recovering with ankylosis. In February, 1915, an attempt at arthroplasty had been made (with temporary resection of the olecranon), and during this operation the surgeon unfortunately cut the ulnar nerve. This seems not to have been discovered at the time since about a month later another operation had been done for suture of the nerve.

When she first came under my care, about seven months after the nerve suture,

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she presented a painful elbow with scarcely any motion and some heat and with no evidence of regeneration in the ulnar nerve. In October, 1915, I explored the nerve resecting a long bulb, and transplanting the nerve anterior to the internal condyle of the humerus, a procedure which permitted end-to-end suture of the nerve, and which at the same time removed it from the scar tissue in which it formerly lay.

After an interval of a year no function had been regained in the nerve except perhaps in the sensory distribution. At this time (October 25, 1916) I did a formal excision of the elbow which was still painful and had an extremely limited range of motion. This operation was not successful, since the range of passive motion secured

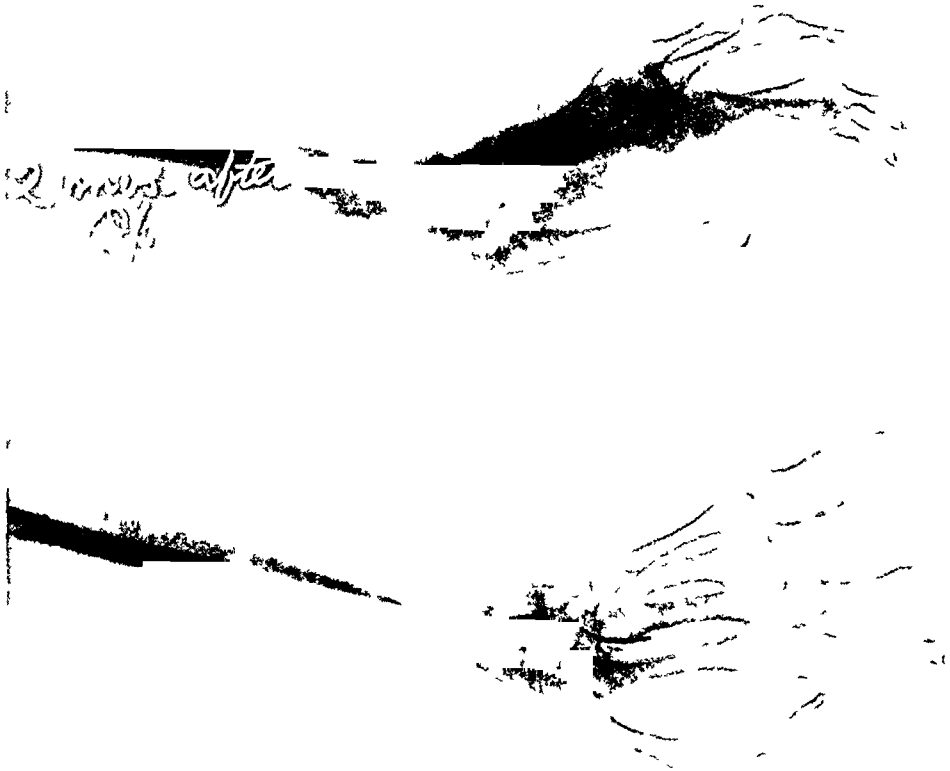


FIG. 3.—Case II. Skiagraph two months after arthrodesis of wrist, bony ankylosis.

was only from 50° to 120° , and practically no active motion was possible, chiefly owing to the extreme muscular atrophy (the elbow had been ankylosed for the previous nineteen years). During my absence in Europe (1917–1919), Dr. A. Bruce Gill, then my assistant, did a re-excision of the elbow, in an effort to increase the range of motion, but the result of this operation was a totally flail joint over which the patient had not any control whatever. In addition her disability was soon increased by slowly developed almost total paralysis of the median and musculospiral nerves, probably from overstretching as they crossed the elbow.

In September, 1920, when she came to me again seeking some improvement in her condition, her arm hung limp by her side, there was no active motion at the elbow, though the biceps could be felt to contract feebly. The elbow was utterly flail and the hand practically useless; there was barely enough power between the thumb and index finger to hold a sheet of paper. The fourth and fifth fingers were in the typical position which follows ulnar paralysis, and there was diminished sensation in the distribution of the ulnar nerve below the wrist. A brace was ordered for her to keep the elbow flexed and bring her hand up to a position where she would have more incentive

to use it. This brace, consisting of a socket to the forearm with counter-balancing weights attached to a rod which extended back of the elbow in the plane of the flexed forearm, permitted passive motion at the elbow.

Finally, in 1923, no improvement having occurred, it was determined to attempt to ankylose the elbow at right angles under the expectation that this would permit recovery of function in the median and musculospiral nerves, and keep the hand where what little power it had would be most useful. But it seemed uncertain whether bony ankylosis could be secured between such atrophic bone ends which had been several inches apart for so many years.

Operation, April 7 1923 at the Orthopaedic Hospital. A longitudinal posterior



FIG 4 —Case II. Skiagraph two months after arthrodesis of elbow, bony ankylosis.

median incision was made, 10 cm long, exposing the bone ends, which were just beneath the deep fascia. The humerus was atrophied so that its end was shaped like an osteotome. The radius and ulna, which were of the same length, presented rounded but also very atrophic ends, which moved on each other in rotation of the forearm. The apposing surfaces of the radius and ulna were removed by saw and gouge forceps, making a slot (shaped somewhat like a tuning fork) to receive the humerus. The end of the humerus was then denuded on opposite sides by a saw, and was placed in the slot between radius and ulna. A hole was then drilled through all three bones at once but as the drill was being withdrawn the end of the humerus broke off. The humerus was then exposed higher up, where less atrophic, and opposite sides of the bone were denuded of periosteum and the cortex roughened by being thoroughly rasped with a saw. The humerus was then replaced in the slot, a hole drilled across it, and a wire passed through all three bones, its ends being twisted down on to the posterior surface of the humerus (Fig 1). After closure of the soft parts in layers with chromic gut the elbow was fixed at a right angle and with the forearm in slight pronation by a plaster-of-Paris dressing, including the entire left upper extremity and chest, the shoulder being in moderate abduction.

ARTHRODESIS OF THE ELBOW

June 16, 1923, the first dressing of the wound was made, nearly nine weeks after operation. The incision was firmly healed, and the elbow solidly ankylosed. A splint was worn for many weeks longer, being abandoned first during the day, and finally even at night. By the autumn it was noted that the hand was growing stronger and eight months after operation the patient had *complete use* of her thumb, index and middle fingers, showing return of power in the median and musculospiral nerves. Only the fourth and fifth fingers remained useless.

October, 1925. This woman, now thirty-seven years of age, has practically no disability remaining except the stiff elbow and the ulnar palsy.

CASE II—Elwood W., now seventeen years old, first came under my care at the Orthopædic Hospital in 1919, at the age of eleven years with a flail-like left upper extremity, the result of an attack of poliomyelitis when five years of age. This attack had come on a couple of weeks after the boy had fractured his left forearm, and his splints were still in place when the poliomyelitis confined him to bed.

His shoulder was almost flail, the humerus dropping from the glenoid, and being easily subluxated anteriorly. There was not enough power in the biceps to flex the elbow, and no power in the triceps. His hand was useless, he could not pick anything up in it, and could barely hold light articles placed in it. There was no power of opposition between thumb and fingers.

Several minor operations were done on the hand by my associate, Dr. E. T. Crossan, in an effort to secure opposition of the thumb, in 1919, in 1922, and again in 1923, in 1922, also the pronator teres was transplanted to make it function as a supinator. In April 1920, the so-called Jones operation to keep the elbow flexed was done; this consisted in excision of a large ellipse of skin from the flexure of the elbow, and suturing of the edges of the raw area with the elbow in acute flexion. This held the elbow in flexion for a few months only (Fig. 2) and no power was regained in the biceps.

By August, 1924, he was able to hold many objects between his thumb and fingers. August 28, 1924, arthrodesis of the wrist was done, fixing the wrist in hyperextension. In February, 1925, the wrist was firmly ankylosed at an angle of 200° (20° hyperextension). He was now able to lift utensils with his hand, and found it more useful in every way. The index finger when flexed strikes the end of the thumb nail; the middle finger has feeble flexion but strikes nothing, no motion in fourth and fifth fingers. In June, 1925, the dropping of the humerus from the acromion was more pronounced. It was determined next to arthrodesis the elbow.

Operation. June 18, 1925. A median longitudinal posterior incision 8 cm. long was made, splitting the triceps and its insertion in the olecranon. The soft parts were reflected until both epicondyles were bared. The humerus was so atrophic it was easily penetrated by blunt instruments except along the two supracondylar ridges. Both lateral ligaments were cut subperiosteally from their humeral attachments and the end of the humerus was brought into the wound, and denuded of all cartilage by means of a hand gouge. The head of the radius and the greater sigmoid fossa of the ulna were treated in the same way and the humerus replaced in contact with the forearm bones. A hole was then drilled from the subcutaneous surface of the ulna through the internal condyle to the posterior surface of the latter and a silver wire was inserted merely to hold the bones in apposition. Good contact of raw bony surfaces was thus secured. The wound was closed in layers, and the elbow fixed about at an angle of 100° with the forearm in supination by a plaster-of-Paris dressing including the chest.

August, 1925 First dressing, ankylosis solid Hand decidedly stronger and more useful

October, 1925 The arthrodesis of the thumb in opposition has brought it into a position where the index finger strikes it during flexion the arthrodesis of the wrist in hyperextension has placed the hand in a useful position on the forearm and has transferred the feeble power of the flexors directly to the fingers, relieving them of any duties as concerns the wrist, and the arthrodesis of the elbow in flexion keeps the hand up where it is possible for it to be of use in the world Perhaps sometime later an arthrodesis of the shoulder will provide for motion of the whole upper extremity through the action of the trapezius, which is strong

REPAIR OF WOUNDS OF THE FLEXOR TENDONS OF THE HAND¹

BY JOHN H. GARLOCK, M.D.

OF NEW YORK, N. Y.

WITHIN recent years, considerable interest has been aroused in the problems connected with the surgery of the flexor tendons of the hand. This has been due, in great part, to a more careful inquiry into the ultimate end results and also to a thoughtful study of the minute anatomy of the structures and the physiological principles involved in their function. Until very recently, the anatomical and functional end results of surgically treated lesions of the flexor tendons, judging from the reported cases and from impressions gained through personal inquiry, have been notoriously poor. When critically analyzed, it is found that there are many reasons for this. In the first place, a frequent error has been the injudicious application of a set operative procedure. A common example is the operative repair of a divided tendon in the presence of an obviously contaminated wound of the superimposed soft parts. Secondary infection with sloughing of part of the tendon is not an infrequent result. Improper operative technic is another common cause for poor end results. In the surgical treatment of flexor tendon injuries, extreme nicety of detail, minimum tissue trauma and great patience are prime requisites. Again, a technically perfect operation on a flexor tendon is of little use to a patient when ultimate function is considered, if the interphalangeal joints moved by that tendon are stiffened and immobile. The same criticism applies to those cases where the tendon sheath has either sloughed or become fixed to the tendon as a result of infection and no attempt is made at operation to reconstruct a new gliding mechanism.

A good result can scarcely be expected when a tendon is repaired in the presence of atrophic or fibrous or sclerosed soft parts. Difficult problems present themselves here and the preliminary reconstruction of the skin and subcutaneous tissues by the use of full-thickness grafts becomes an important and necessary step in the satisfactory progress of the case. Finally poor results can be expected uniformly when the post-operative care is carelessly carried out.

In attempting to systematize and analyze end results, it soon became evident that it was necessary to adopt some working classification which would incorporate every type of tendon injury. It seemed hardly fair to compare the end results of simple, single, primary tenorrhaphies with the cases requiring reconstruction of the soft parts and tendon grafting. As the work progressed the following classification suggested itself:

A *Immediate Primary Tenorrhaphy*

B *Early Secondary Tenorrhaphy*

* Read before the Surgical Section of the New York Academy of Medicine, October 2, 1925.

In this group, the tendon repair is attempted after the initial wound of the soft parts has healed. Every case within the arbitrarily selected period of four to six weeks following the injury falls under this heading.

C Late Secondary Tenorrhaphy

Every case operated upon later than six weeks after the original injury comes in this group.

D Late Secondary Tendon Repair with Reconstruction of the Soft Parts

It can readily be seen that a variety of conditions would be included here. The more important and those most frequently encountered, present either loss of the tendon sheath or adhesions between tendon and sheath as a result of trauma and infection or atrophy and fibrosis of the soft parts. Any combination of these pathological conditions can be found in the same case.

E Tendon Grafting

Before taking up the treatment

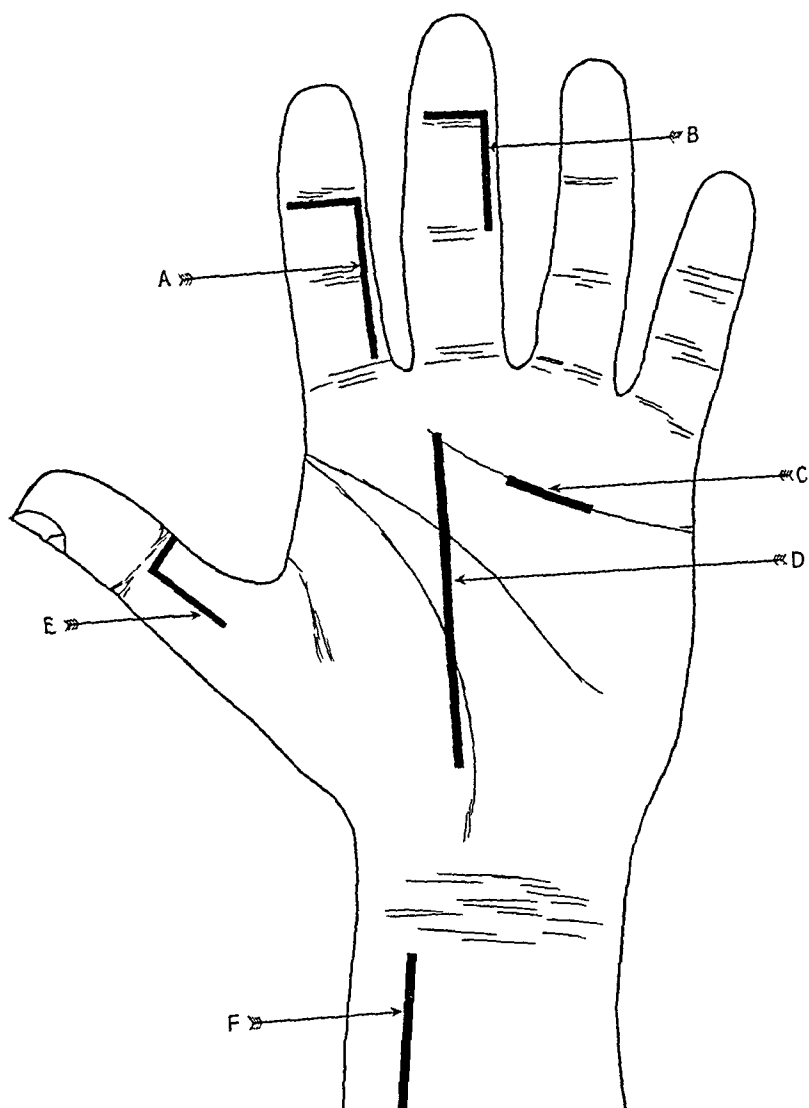


FIG. 1 —Diagrammatic sketch representing the various incisions used in exposing the flexor tendons for operative repair. A Inverted L-shaped incision with long arm for exposing divided flexor profundus and sublimis tendons. B Incision for exposing divided flexor profundus tendon. C Transverse incision in palm for exposure of the retracted proximal end. D Longitudinal incision made to one side of the tendon when the lesion is situated in the palm of the hand. E Incision for exposure of divided flexor longus pollicis near its insertion. F External lateral incision for exposure of the retracted proximal end of the flexor longus pollicis tendon.

of each group, consider a few basic principles which must receive general application in all tendon work. The operative technic should be practically faultless. Not only must asepsis be rigid and complete, but the handling of all the tissues must be carefully done. It was Bunnell who originally described an "atraumatic technic" and made it particularly applicable to tendon surgery. Even with the best asepsis, trauma applied

to tissues will, in an appreciable number of cases, furnish the necessary conditions for the few unavoidable organisms present to cause infection. Aside from trauma, other factors that determine infection are heavy catgut, large knots, dead spaces, tension of sutures, mass ligation, too many stitches, foreign bodies in fat, closure with incomplete hæmostasis, use of very hot sponges and drying of the tissues due to prolonged exposure. Realizing,



FIG. 2.—M. G. Traumatic division of the flexor profundus tendon of the right middle finger one cm. proximal to its insertion in the distal phalanx. Operation performed thirteen days after injury at which time the wound of the skin was completely healed. Operation: Esmarch bandage inverted. L. incision the horizontal limb corresponding to the distal flexion crease. Tendons sutured with silk according to the Bunnell technic. The photographs a and b indicate the result at the end of one year.

therefore, that unless great attention is paid to minute details in technic infection or fibrosis with a firm unyielding cicatrix will result, what should be the conception of an atraumatic technic? We should maintain a wholesome respect for tissues and keep our mind always on their post-operative reaction. To avoid the trauma of sponging, a bloodless field obtained by the use of an Esmarch bandage or blood-pressure cuff is indicated. Sharp dissection, sharp scissors, knives and needles, accurate hæmostasis with fine hæmostats, the use of very fine ligature material, reducing the time of opera-

tion to a minimum, good team-work, conservation of movements by careful study and planning beforehand, these are but a few of the factors to be considered in the attainment of an atraumatic technic.

In the later secondary tenorrhaphies and the reconstruction cases, it must not be forgotten that absolute freedom of mobility in the finger joints is assured before any operative interference is attempted. One should not

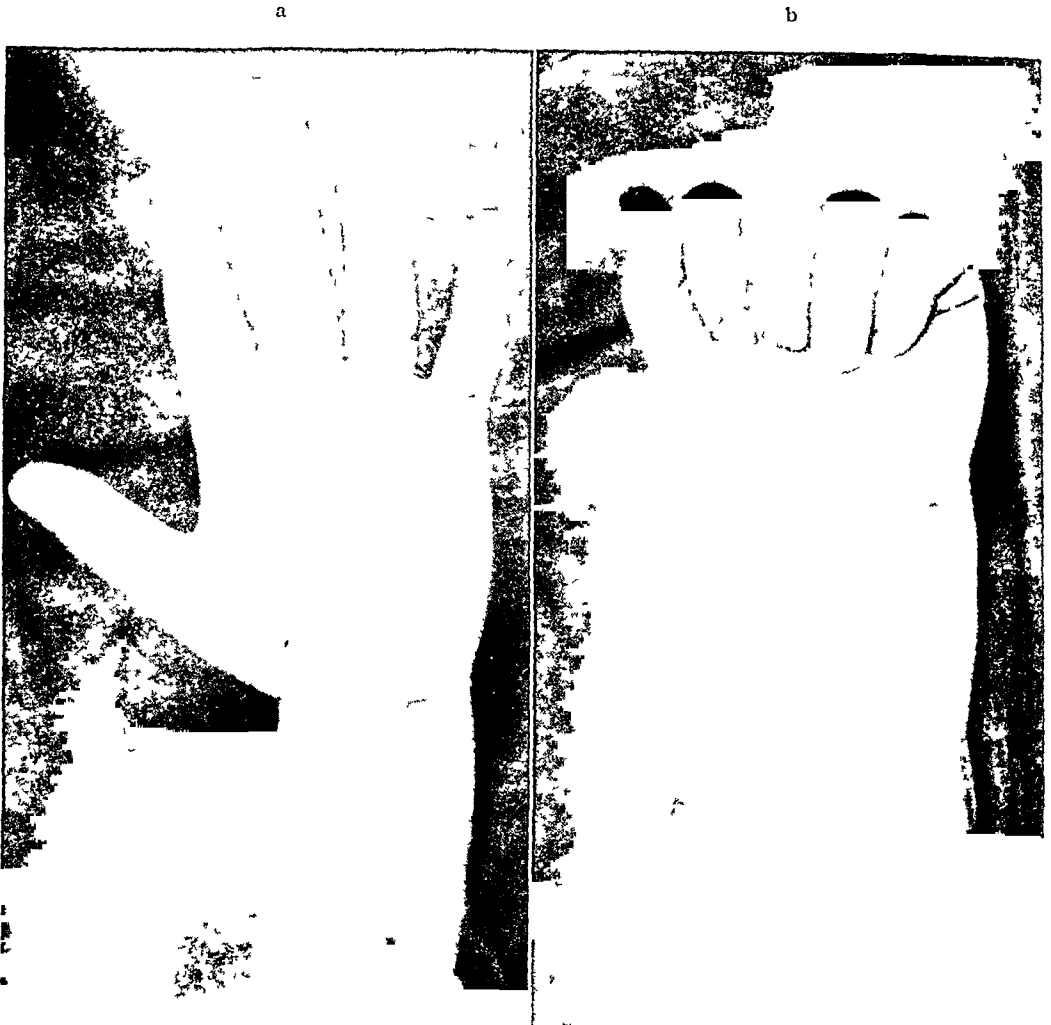


FIG. 3—L. F. Traumatic division of both flexor tendons of the left middle finger, the point of division being in the region of the outer end of the distal flexion crease of the palm. Operation performed six weeks after injury, revealing completely divided tendons with an organizing hæmatoma stretching between the divided tendons. *Operation*—Esmarch bandage, longitudinal incision on the inner side of the anatomical situation of the flexor tendons, suture of the divided tendons with silk according to the Bunnell technic. Active motion started on the eighth post-operative day. Photographs a and b show the result at the end of one year.

hesitate to employ every remedy at his disposal in order to obtain this necessary joint pliability. In this connection, it has become evident that a great deal can be accomplished by the judicious use of "home-made" aluminum or buckle splints, utilizing the principle, as we have termed it, of gradual compressive splintage. This applies particularly to the metacarpo-phalangeal and proximal interphalangeal joints.

When we come to consider the treatment of cases falling into Group 1, as

outlined above, one issue of paramount importance arises and must be decided immediately. That is the character of the wound of the skin and the subcutaneous tissues and the procedure to be adopted. In the presence of a clean incised wound within the initial twelve hours following the injury, immediate tenorrhaphy can be done with safety, after appropriate cleansing. When the wound is ragged and dirty, obviously grossly contaminated, and the surrounding skin is covered with grime and dried blood, it is the writer's opinion that the tenorrhaphy should be deferred until the wound has healed, the immediate interference consisting solely of a general cleansing and debridement. The impression has been gained that the end results have been better since adopting this principle. Certainly, this delay of two or three weeks has not given rise to any demonstrable increase in fibrosis or adhesion formation nor has it rendered the secondary repair more difficult.

The site of the skin incision depends, in general, upon the point at which the tendon was divided. *It should never be made directly over the tendon* because the scar will become adherent to the tendon sheath. Permanent impairment of function is almost sure to follow if the incision in the fingers is a median longitudinal one. This incision should be condemned here as well as in the treatment of suppurative tenosynovitis of the flexor tendon sheaths. In the palm it matters very little whether the incision is longitudinal or transverse. The advantage of the latter is that it can be placed in the transverse creases. In the fingers, however, experience has shown that a long continuous side incision, while anatomically and cosmetically correct, has a tendency to contract and pull the finger down slightly into flexion. Although this produces only very slight deformities with excellent function, in an effort to avoid it and obtain a more ideal result, the incisions shown in Fig. 1 were devised. It will be noted that this incision has the shape of an inverted "L," the long arm extending along the side of either the middle or proximal phalanx and the short arm corresponding to one of the flexion creases. The triangular flap thus produced is dissected away from the tendon sheath and a good exposure is obtained.

To preserve the mechanism of a tendon pulling around three corners thus avoiding a bow-string effect, one must never cut the little pulleys, which are really thickenings in the tendon sheath at the interphalangeal joints. In fact, it has been found distinctly advantageous to avoid as much as is commensurate with obtaining a good repair cutting any part of the tendon sheath. To accomplish this, a separate incision is made over the approximate location of the retracted proximal end and through the distal original wound of the tendon sheath a looped strand of silk-worm gut is passed proximally until it reaches the retracted tendon. A small transverse incision is made in the sheath at this point, the silk suture is placed in the tendon and the silk-worm gut is tied to this suture which is now pulled distally with its attached tendon through the intact sheath as far as the original wound. The tenorrhaphy is now completed.

In the ideal repair of a tendon, a number of requirements must be met

1 Trauma must be eliminated 2 The sutures should be so placed as to leave a minimum of suture material on the surface of the tendon 3 The knots must be buried 4 The divided ends must be brought into accurate apposition 5 The suture material must be of great tensile strength 6 The sutures must be so placed that a considerable amount of tension may be put upon them without causing them to pull out The Bunnell tendon clip dis-



FIG 4—A R Divisions of flexor tendons of the left index finger by a buzz-saw in the region of the proximal flexion crease Operation performed three hours after injury was sustained and consisted of debridement and primary suture of divided structures Tendons repaired with silk according to the Bunnell technic Active motion started on the seventh post-operative day Photographs a and b indicate result four months after injury

tinctly aids in fulfilling these requirements Combining their use with fine silk of high tensile strength and very fine short straight needles, a satisfactory repair can be obtained Following the tenorrhaphy, the incisions in the tendon sheath should be closed with very fine catgut Where the sheath, of necessity, has been opened wide, this is very often extremely difficult The important point to bear in mind is to avoid traumatizing the synovial surface of the tendon sheath by numerous needle punctures

As to after-treatment How long should the part be immobilized? It

has been our custom to immobilize the repaired finger in acute flexion with the wrist in flexion, using a very light plaster glove, for a period of from five to ten days, depending upon the intelligence and spirit of cooperation of the patient. At the end of that time, the glove is removed and active motion within the limits of pain instituted. Inasmuch as prolonged immobilization almost surely fosters the formation of adhesions, it is important to begin

a

b



FIG. 5.—L. R. Traumatic division of structures at front of right wrist. Structures divided were the following: Median nerve, ulnar nerve, palmaris longus tendon, flexor sublimis digitorum tendons, flexor profundus tendons, flexor carpi radialis tendon, radial artery. Operation performed three hours after injury, consisting of a debridement and primary suture of divided structures. Silk was used in repair of the tendons. The nerves were repaired by inserting peri-neural sutures of fine silk. Aside from a mild superficial skin infection, convalescence was smooth. Active motion was started on the tenth post-operative day. Photographs a and b, indicate result at the end of one year.

motion early. To diminish the possibility of placing too much tension on the suture line, the hand is held in acute flexion by a check-rem adhesive arrangement running from the hand to the forearm. This does not prevent active flexion and extension of the fingers but does diminish the intensity of contraction of the muscles. It is necessary to wear this check-rem for four to six weeks at the end of which time union will have become firm. After this period, many other remedies may be utilized, as frequent strong galvanic

stimulation of the muscles to produce strong contraction thus helping to break tiny adhesions scientifically applied baking and massage hot soaks whirlpool baths re-education exercises passive motion etc. While we do not question the value of these procedures and constantly make use of them it is felt that more can be accomplished by carefully controlled and personally encouraged active motion in the initial six or eight weeks of treatment. The time element must also be considered as having a direct bearing on the eventual outcome, inasmuch as an optimum result may not be obtained until a period of four to six or more months has elapsed.

When the flexor profundus tendon has been divided at or near its insertion in the base of the distal phalanx the repair is difficult and the end results, as a rule, are only fair. This is probably due to the fact that because of the shortness and inaccessibility of the distal segment considerable trauma is caused in placing the sutures and an accurate end-to-end apposition thus diffi-

PRIMARY TENORRHAPHIES—18

Site of injury		Good	Fair	Poor
Near insertion of profundus tendon	6	2	1	3
Over middle phalanx	2	1		1
At proximal phalanx (both tendons)	2	1	1	
In palm	6	5	1	
At wrist	2	1	1	

FIG. 6.—Chart of end results of 18 primary tenorrhaphies

cult to obtain. Obviously, dense adhesions soon form and motion is greatly limited. Since the principle of avoiding longitudinal incisions in the tendon sheath was adopted, the impression is gained that the functional results in this type are better.

The cases falling into Group 2 of the above general classification are treated essentially along the same lines. Occasionally, it will be found that where mild infection has preceded the healing of the wound of the soft parts, a firm cicatrix has resulted. Or dense scar tissue may result from an extensive traumatizing laceration. In such instances operative treatment includes excision of the scar freeing of the tendon sheath, the insertion of a free fat transplant from the triceps fascial region a plastic repair of the skin or a pedicled skin graft, the prime reason for these procedures being the prevention of new scar tissue formation about the tendon sheath. The indications for, and the limitations of the use of such methods must be considered carefully in each case.

When repair of divided tendons is attempted at any time later than the initial six weeks following the injury, *i. e.*, in the later secondary cases additional conditions are found which must be dealt with. The proximal end of the tendon will be found retracted to its farthest point and usually inti-

WOUNDS OF FLEXOR TENDONS OF HAND

mately adherent to its sheath by scar tissue. Or it may lie free in its sheath, but showing a curled-up, friable atrophied end. Very often, however, it will be found that the ends of the tendon are lying free in the sheath, which itself is smooth and glistening, all structures appearing quite normal. All degrees and gradations of secondary changes may be encountered up to the extreme type where a mass of dense scar tissue extends between the two ends of the tendon, binding all structures together into a firm cicatrix. The operative treatment depends upon the extent of the conditions found. In the simple cases, without scar tissue, tenorrhaphy may be done according to the principles already outlined. The bulbous tip of the retracted proximal segment can be excised and very often sufficient tendon remains to allow of a satisfactory repair. To free a tendon adherent to its sheath, use is made of a tendon stripper, an instrument originally described by Bunnell. The adhesions that form following such a procedure must be relieved by a second operation.

EARLY SECONDARY TENORRHAPHIES—10

Site of injury		Good	Fair	Poor
Near insertion	4	3	1	
Middle phalanx none				
At proximal phalanx (both tendons)	1		1	
In palm	4	3		1
At wrist	1		1	

FIG. 7.—Chart of end results of ten early secondary tenorrhaphies

Although not ideal, good results have been obtained. When the repair is done in the region of the palm and there has been a loss of part of the tendon sheath, a gliding mechanism must be created to prevent the reformation of adhesions. This is best done by encircling the exposed part of the tendon by a sleeve of free fat graft. This fat must have definite gliding properties (paratenon) and is exemplified best by the fatty tissue over the triceps tendon. If, however, the lesion is located in the finger proper, it will be found that this procedure cannot be carried out because of the limited space. Under these circumstances, judging from the writer's limited experience and certainly from the sanguine reports of Bunnell and others, it seems feasible to excise the exposed portion of the tendon and insert a free tendon graft (taken from the extensor tendons of the toes) with its encircling sheath, care being taken not to divide the little pulleys in the region of the interphalangeal joints. Here again, as in Group 2, any abnormalities in the superimposed soft parts must be accorded separate attention before a good result can be expected.

Those cases (Group 4) with more or less extensive pathology in the skin and subcutaneous tissues in addition to lesions in the tendons and their sheaths present interesting problems. There may be fibrosis and atrophy of the subcutaneous tissues with cicatrization of the skin, due either to extensive

trauma, or an old infection, or the use of the ill-advised median longitudinal incision. The so-called flexion-contracture is a common example in point. Before attempting any operative treatment, one must be sure that the joints are fairly pliable. This may be obtained by the judicious use of splints, following the principle of gradual stretching and avoiding violent brisement forc   under anesthesia. A finger that is permanently stiffened had better be amputated. It is obviously wiser to first replace the sclerosed soft parts by healthy tissue before attempting any operative work on the subjacent tendons. The contracting scar tissue is, therefore, excised and the finger is fully extended, cutting the capsule of the joints, if necessary, to accomplish this. The finger is then immobilized on a previously prepared sterilized metal splint. A tubularized pedicled graft, made ten to twelve days before on the chest or abdomen, is then sewn over the raw area. The objections to the free full thickness or Wolfe grafts are: 1. That there must be perfect and complete

LATE SECONDARY TENORRHAPHIES—6

Type of case	Good	Fair	Poor
3 months after injury, near insertion of profundus 1			1
7 weeks to 4 months suture with fat transplant (palm) 3	2		1
8 weeks and 3 months Suture after use of tendon stripper (palm) 2	1	1	

FIG. 8.—Chart showing end results of 6 late secondary tenorrhaphies.

immobilization. 2. That there must be firm even pressure applied over the grafts to prevent any accumulation beneath them, a difficult thing to accomplish in the fingers, and 3. That the Wolfe grafts have a great tendency to become pigmented. Thiersch grafts are inadequate for this purpose because they do not supply enough tissue.

After the graft has taken the pedicle is cut away and the cut end is then sewn in place. Before undertaking any work upon the tendons, one must wait until all possibility of latent infection and all post-operative induration has disappeared, probably three or four months. Only by so preparing a suitable field is it possible to free adherent tendons, repair tendons or insert tendon grafts without fearing the reformation of adhesions. The principles as outlined may be applied to any part of the hand, the important point being that skin reconstruction and tendon work cannot be done at one and the same time, as a general rule.

The question of tendon grafting calls for a clear understanding of the anatomy of tendons and their surrounding structures. This has been carefully worked out by Maver, of New York, and by Biesalski, who emphasized so well the importance of the gliding mechanism. Briefly their findings are as follows. When a tendon pulls in a straight line, it is encircled by loose fatty tissue called paratenon, which is pulled back and forth in its central

WOUNDS OF FLEXOR TENDONS OF HAND

zone with movements of the tendon. When a tendon pulls around a corner, it is enclosed in a tendon sheath, in which the surface of the tendon (epitenon) moves freely within the synovial lining of the sheath. This is found in the hand. In other parts of the body a blood-vessel-bearing mesotenon is present, being attached to the side of the epitenon opposite the side of friction. In the hand the mesotenon is represented by the attenuated structures, the *vincula tendineæ* (*Ligamenta brevia* and *Ligamenta longa*). With this picture of the anatomy in mind, the main indication in all tendon work is clear, *viz.*, to maintain the old or supply a new gliding mechanism.

When, upon exposing a tendon and its sheath that have been the seat of infection, it is found that these structures are glued together by adhesions, one of three procedures may be undertaken. If the adhesions are not very firm or extensive, the tendon may be freed by the use of a tendon-stripper, active motion being instituted immediately. Very often a complete return

TENDON PLASTIC WITH SKIN RECONSTRUCTION—7

Type of case	Good	Fair	Poor
5 flexion contractures, 2 due to trauma, 3 due to infection	2	2	1
Scars in palm—adherent tendons and loss of tissue 2		1	1

FIG. 9.—Chart showing end results of 7 cases of tendon plastic operations with skin reconstruction. The chart is self-explanatory.

of function is noted. Secondly, if the pathology is more pronounced in the palm proper, the tendon can be freed by the stripper and a paratenon type of gliding mechanism imitated by inserting sleeve-like about the roughened tendon, a free fat graft taken from the triceps region. Or the involved part of the tendon can be excised and a free graft from the palmaris longus tendon with its surrounding paratenon inserted. When such grafting is done in the proximal half of the palm or in the forearm, the possibility of adhesion formation is less and results are good. When it is done in the distal half of the palm and the fingers, there is rarely return of complete function. Such being the case, it seems feasible to imitate the conditions found in the normal hand, by inserting free grafts of tendons with their respective tendon sheaths. The best source of such grafts can be found on the dorsum of the foot, namely, the tendons of the *extensor communis digitorum*. The *extensor brevis-digitorum* takes up whatever function that may be lost by the removal of such grafts and toe drop does not occur.

In performing the grafting, it is necessary to free the old tendon by planing it away with the stripper, care being taken not to injure the pulleys of the old tendon sheath. If the flexor sublimis tendon itself is diseased or in the way, it should be removed. It is not necessary to attempt to replace this tendon because it is not needed for function and because the procedure then becomes too complicated. Indeed this tendon may sometimes be used as the

source of a graft when it is free of pathology. The sutures are placed in the ends of the graft which is then pulled through the old sheath, surrounded by its own normal theca. The graft is then united to the ends of the old tendon and the new sheath is sutured. In all tendon grafting, the principle, as determined by Mayer, of the proper tension for uniting a tendon must be followed. When the origin and insertion of a muscle are approximated as close together as possible, the tension of the tendon should be zero, the only exception being in the case of a muscle, which, owing to division of its tendon, has long been contracted.

The after-treatment is, of course, most important. Active motion should not be started as early as in the simple tenorrhaphies because two suture lines have been made, thereby producing two weak points instead of one. Then, again, foreign tissue has been introduced and it is questionable if too early motion is entirely beneficent. Carefully controlled and personally directed

TENDON GRAFTS—4

Type of case	Good	Fair	Poor
Free graft of palmaris longus tendon in palm 2	I	I	
Free graft of flexor sublimis tendon 1			I
Free graft of extensor communis digitorum in foot 1		I	

FIG. 10.—Chart showing the end results on 4 cases of free tendon grafts. The chart is self-explanatory.

motion may be instituted after fourteen days, gradually increasing its range day by day.

The accompanying charts indicate clearly the functional end results obtained in a series of forty-five consecutive tendon cases, illustrating varying degrees of pathology. An examination of Figs. 6 and 7 would seem to indicate a paradoxical discrepancy in the end results of those cases where the flexor profundus tendon was divided near its insertion. That is, in the primary group, of six cases, three were classified as poor whereas in the early secondary group of four cases, three were good and one was rated as fair. This is due to the fact that in the early secondary cases a short inverted "L"-shaped incision was used instead of the long lateral one, thereby diminishing the amount of trauma. In addition, most of the primary tenorrhaphies were done before the inverted "L"-shaped incision was adopted. It will be also noted that the best results are obtained in those cases where the point of division is in the palm of the hand.

A SKIN FLAP COVER FOR PROJECTING INTESTINE*

By MOSES E STEINBERG, M D

OF PORTLAND, OREGON

THE various methods for bringing the hollow viscera to the outside of the abdominal wall as permanent therapeutic or experimental fistulæ are not without shortcomings. The many operations for a colostomy have the drawback that they open on the same plane with the skin of the abdominal wall.

The colostomy cup has no means of anchoring itself at the artificial anus, allowing the fecal contents to escape between the cup and the abdominal wall. This condition becomes aggravated if the feces are soft or liquid, the skin being soiled for a large area about the colostomy opening. The patient with a permanent gastrostomy, or a permanent jejunostomy opening is always more or less annoyed by the erosion of the surrounding skin from the escape of stomach or intestinal contents. The enumerated disadvantages also apply to the experimental fistulæ in animals performed for the purposes of research. The collection of the contents escaping from the fistulæ is at times quite difficult to carry out due to the fact that some of the contents escape outside of the collecting tube, resulting in faulty experimental data.

Hoping to eliminate some of the objectionable features encountered in producing the various fistulæ, an attempt has been made to bring the hollow viscera outside of the abdomen in such a manner as to cause a permanent protrusion beyond the plane of the abdominal wall. The peritoneal lining of the viscus is surrounded with flaps of skin.

A brief description of the technic used in performing six permanent colostomies in dogs will be here given. The initial skin incision may correspond to the peculiar conditions of a given case. In our experimental work we used the left rectus incision. After exploration the descending colon is delivered and severed in the usual aseptic technic. The proximal and distal loops are closed by ligature and purse-string suture, carefully avoiding injury to the blood supply of the bowel. The distal loop is thrown back into the abdominal cavity and the proximal loop with its mesenteric attachment is



FIG 1 —
Initial skin
incision

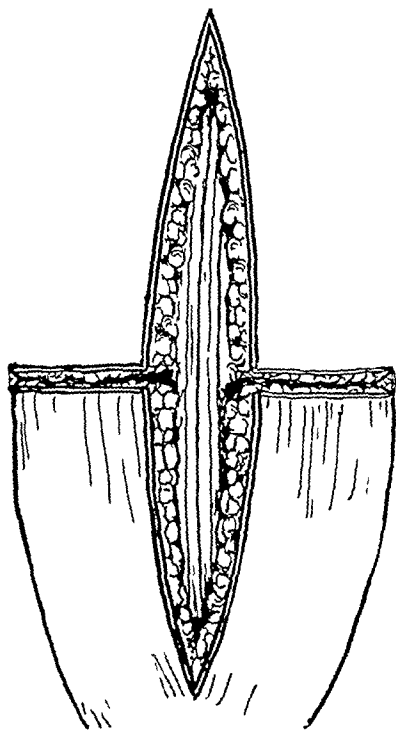


FIG 2 —Incisions to form the skin
flaps

* From the Department of Physiology of the University of Oregon Medical School

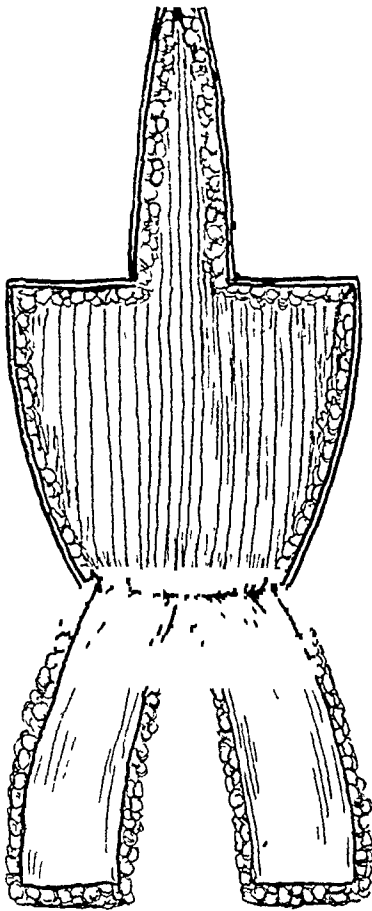


FIG 3 —Skin flaps dissected and reflected

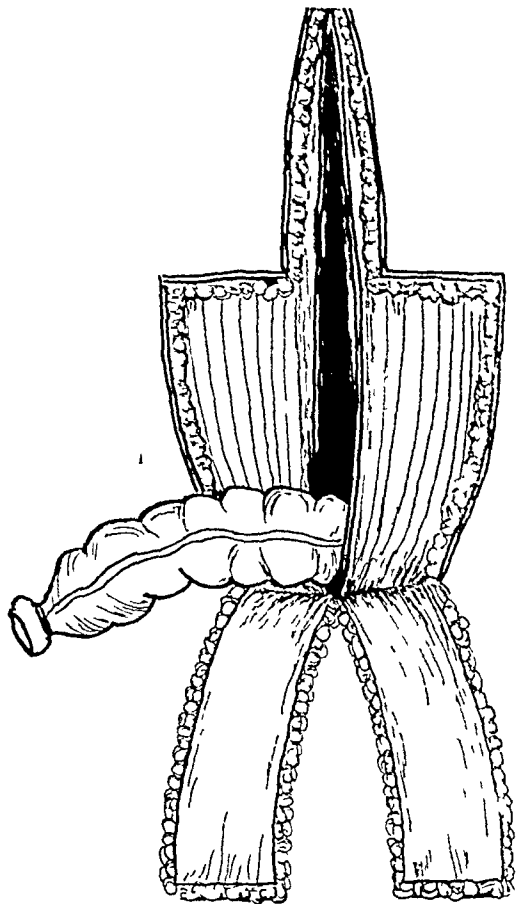


FIG 4 —Large bowel delivered to the outside

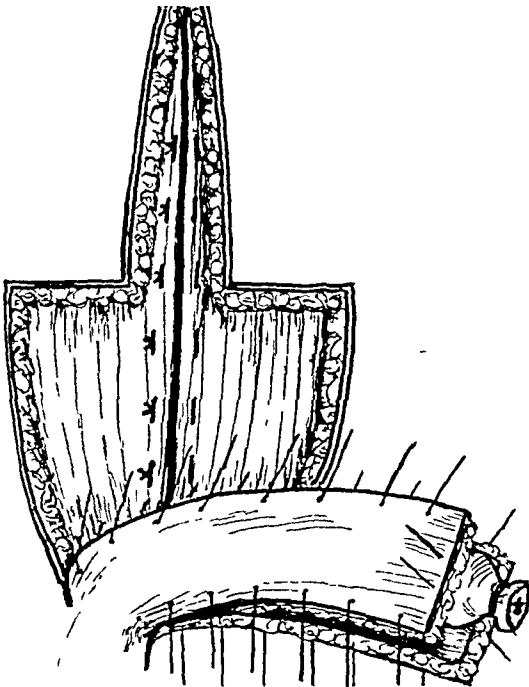


FIG 5 —Peritoneum muscle and aponeurosis of operative wound closed. Skin flaps made to surround protruding bowel

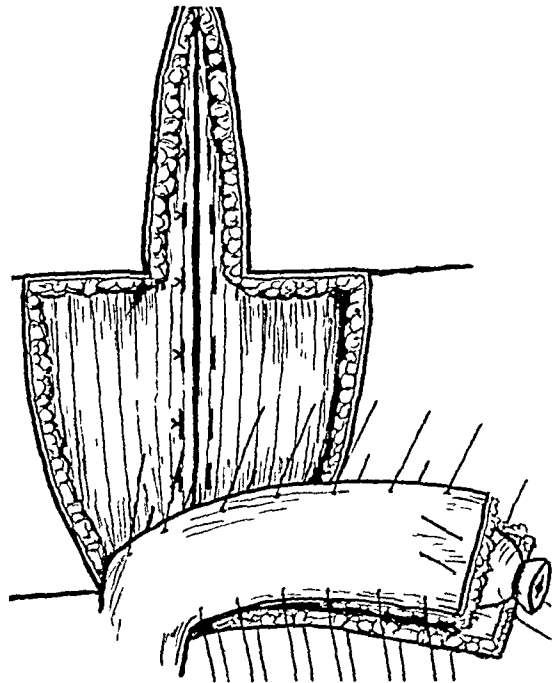


FIG 6 —Skin is undermined along incisions perpendicular to the initial incisions in order to close the skin defect in the abdominal wall

SKIN COVER FOR PROJECTING INTESTINE

kept outside and made to protrude for five or six centimetres beyond the plane of the abdominal wall. The skin flaps which surround the protruding viscus are fashioned from the initial exploratory incision in the way depicted in the accompanying illustrations (Figs 1 to 7). The colostomy is not opened until three or four days later when the superfluous bowel uncovered by skin is removed with the cautery.

So far no opportunity has presented itself to perform this method of colostomy on a human subject. It will have its limitations since it may not lend itself to easy performance when the bowel is inflamed and actually distended. Its performance would only be possible where the mesenteric attachment of the bowel will permit its delivery from the abdominal cavity. From the experiments on animals it appears that the performance of this type of colostomy should not be complicated on the human being. It should heal easily and offer better artificial control of the anus. Pressure with gauze and adhesive should be sufficient to control the colostomy opening. The colostomy cup can be applied when necessary over the protruding bowel in the same manner as a urinary

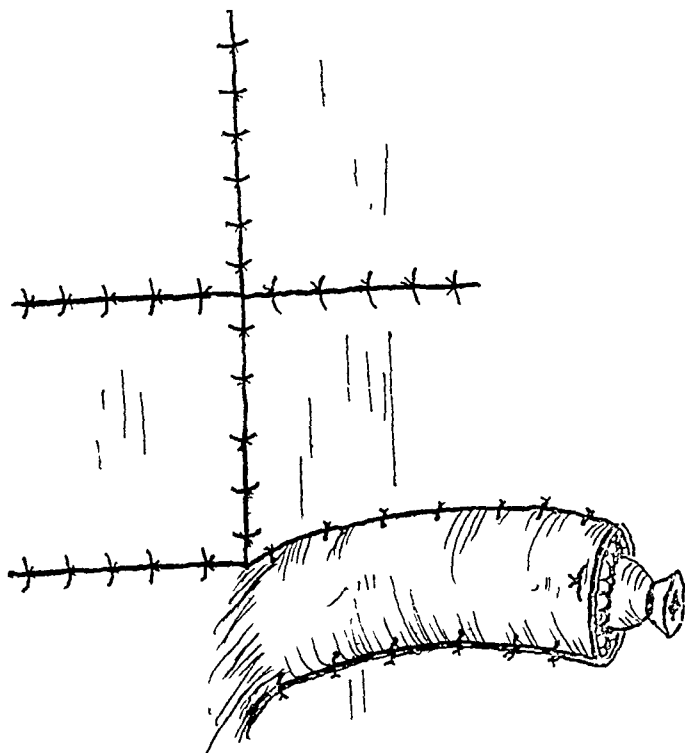


FIG 7 — Operation complete

bag is applied over the penis in urinary incontinence. The skin flap method is suggested for the following clinical or experimental fistulæ: Colostomy, jejunostomy, gastrostomy, cesophagostomy, fistulæ for experimental research.

We are now engaged in working out the technical details in the methods of performance of these fistulæ and shall report on the work in due time.

Our work on this problem has started over a year ago. Lately our attention has been called to an article in *La Presse Medicale*, No. 12, February, 1925, by Prof. O. Lambert. There one finds a description of an artificial anus somewhat similar to the one described in this article.

I wish to acknowledge the kind assistance of Tom Wyatt in connection with this work.

A PERINEAL ELEVATOR

BY CHARLES Y. BIDGOOD, M.D.
OF HARTFORD, CONN.

It has often been emphasized that one of the most important factors in the facilitation of perineal surgery is having the patient in the correct position *ie*, with the perineum parallel to the floor. Success in attaining this exaggerated position requires that the pelvis be elevated and flexed, and that the thighs be flexed on the abdomen.

If prostatic and seminal vesical surgery is attempted with the perineum in a position of less elevation than this, the technical difficulties of any operation are immediately increased, because the laxity of the central tendon, and the transversus perinei and recto-urethralis muscles obscures these important landmarks, thereby rendering the approach to the prostate and seminal vesicles more difficult, and more hazardous, in so far as injury to the rectum is concerned. It is quite possible that failure to recognize these facts has helped to earn for the perineum the undeserved reputation of being a difficult operative field, with the result that it is generally avoided, and that some operations in this region have not attained the popularity to which their merit entitles them.

Although combined cystoscopic, X-ray and operating tables, with a perineal elevator attached, as, for instance, the table of Hugh Young, are in the market affording an complete and efficient mechanism, most surgeons, are not fortunate enough to possess one of these tables, and are compelled to use the ordinary operating table, with the patient in the usual lithotomy position, which is very inadequate, or the Halsted board, which is better, but not ideal.

The elevator illustrated here was therefore constructed to fulfill the following requirements: (1) To give the maximum degree of elevation. (2) To be attachable to any operating table. (3) To be light, so that it can be easily carried from one operating room to another. (4) To be simple and strong in its construction.

It is composed of two parts, the elevating mechanism (Fig. 1), and the leg pieces for flexion of the thighs (Fig. 2).

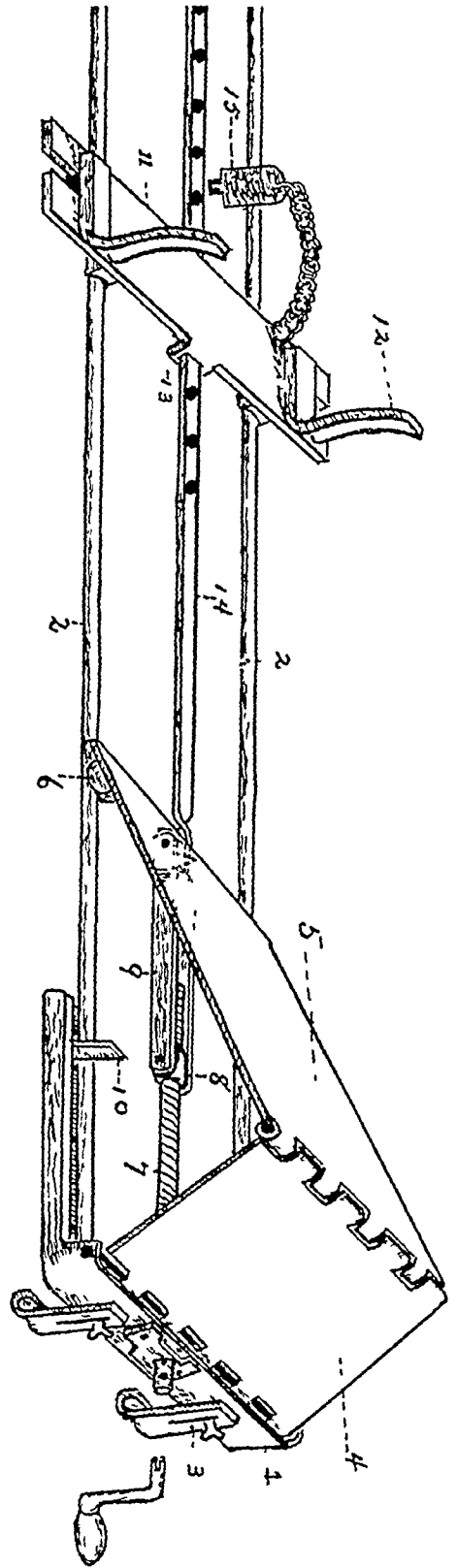
The sketch (Fig. 1) illustrates the elevating mechanism. It is composed of the steel footpiece (1), which is one inch high, and six inches wide. Attached to each end of this footpiece is a half round steel track (2), extending backward thirty-six inches. To the footpiece (1) are also attached two adjustable hooks (3) whose function is to grasp the flange at the end of the operating table, thereby immobilizing the apparatus. Projecting outward one inch from the centre of the footpiece is the crank end of the screw (7). The elevating planes (4 and 5) are made of aluminum and are so constructed that when the anterior plane (4) is elevated until it is

perpendicular to the level of the operating table, the posterior plane (5) is at an angle of 45 degrees to it. The anterior plane (4) is hinged to the footpiece (1). The posterior plane is equipped on the under surface at each corner, posteriorly, with a runner (6), which fit the steel tracks (2), so that when the plane is elevated, it slides over the tracks.

The screw (7), extends backward underneath the elevating planes and is threaded through the small steel block (8). To each end of this block is hinged a steel strip (9). These extend backward and are hinged at their other ends to a steel block which is fastened to the under surface of the edge of the posterior plane (5). The space between the strips (9) receives the screw (7) when the plane (5) is drawn up, so that it never projects from underneath the edge of the plane. The patient is, therefore, never endangered by it. The small upright (10), which is one inch high, serves to give the planes the necessary initial break, and to prevent their sagging under the weight of the patient.

The mechanism for bracing the shoulders consists of an aluminum cross-piece (11), which is two inches wide and which is deeply notched at each end, so that the upright shoulder braces (12) can be detached when desired, and can be adjusted to the width of the patient's shoulders. On the under surface of the piece (11) are attached runners to fit the tracks (2). In the centre of the cross-piece (11), there is turned down from the anterior and posterior edges a flange (13) which has a slot cut in it. Through these slots is run the flat steel strip (14). This strip is hinged at one end to the block on the under surface of the posterior plane. Its posterior half is perforated by holes one inch apart. These holes are to receive the steel pin (15). By this arrangement, the shoulder braces can be adjusted to the length of the body, and held in the proper place by the pin being placed in the hole pre-

FIG. 1.—Elevating mechanism for exposing perineum



senting behind the cross-piece (11) Also, the attachment of the strip (14) to the posterior plane causes the shoulder braces to be pulled up as the plane is elevated This is necessary because it prevents the elevating planes from slipping from underneath the buttocks as they rise, the result being that the patient is really pulled up into position

The mechanism for flexion of the thighs is shown in Fig 2

The mechanism controlling the action of the leg pieces consists of the steel part (1), which is shaped like a tuning fork The downward projecting rod (2), which corresponds to the handle of the tuning fork is made to fit into the Bierhoff clamps that are found on all operating tables The uprights

(3) are perforated near their base by the hole (4), into which the steel pin (5), is made to fit

Between the uprights (3) is dovetailed the piece (6), which is hinged at the point (7) Projecting backward from the lower edge of this piece is a flange (8), which is perforated so that the holes in it coincide with the holes in the base of the uprights (3) To the

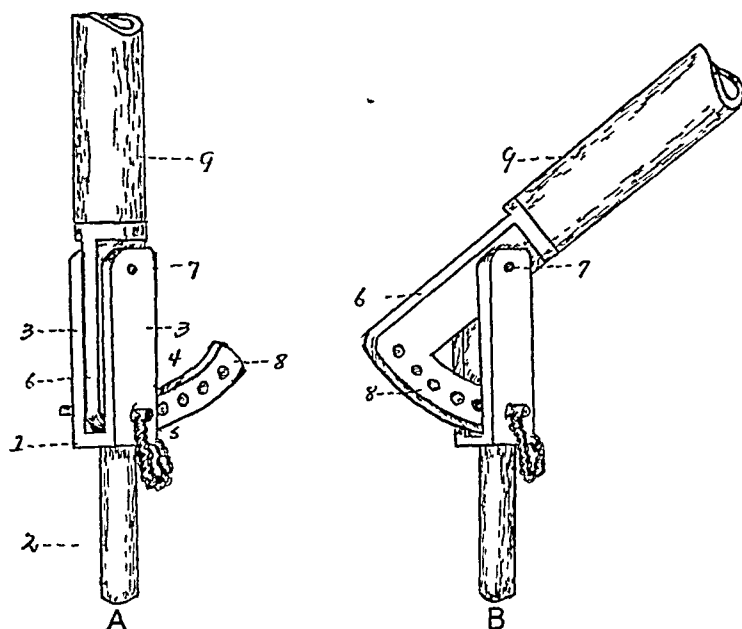


FIG 2 —Leg pieces for flexion of thighs See also Fig 4

upper end of the piece (6) is attached a pipe (9), which is thirty inches high (This is cut down in the sketch)

Figure 3 shows the pipe in the upright position, and figure 4 shows it dropped back 45 degrees, and held in position by the pin (5) passed through the holes near the base of the uprights (3), and the coinciding hole in the flange (8)

Method of Operation —The elevator is placed on the operating table with the planes lowered, and the hooks adjusted to engage the flange of the table (Fig 3) The patient is then placed on it, and the shoulder braces adjusted to the length and width of the body The pin is then dropped into the hole presenting behind the cross-piece which holds these braces

The leg pieces are then placed in the Bierhoff clamps and made fast, with the bars in the upright position The patient's thighs are flexed, and the legs placed around the bars, which are then pushed back as far as possible, and fixed in this position, as described in Fig 2-B The footpiece of the operating table is then lowered, and the pelvis elevated by attaching the

A PERINEAL ELEVATOR

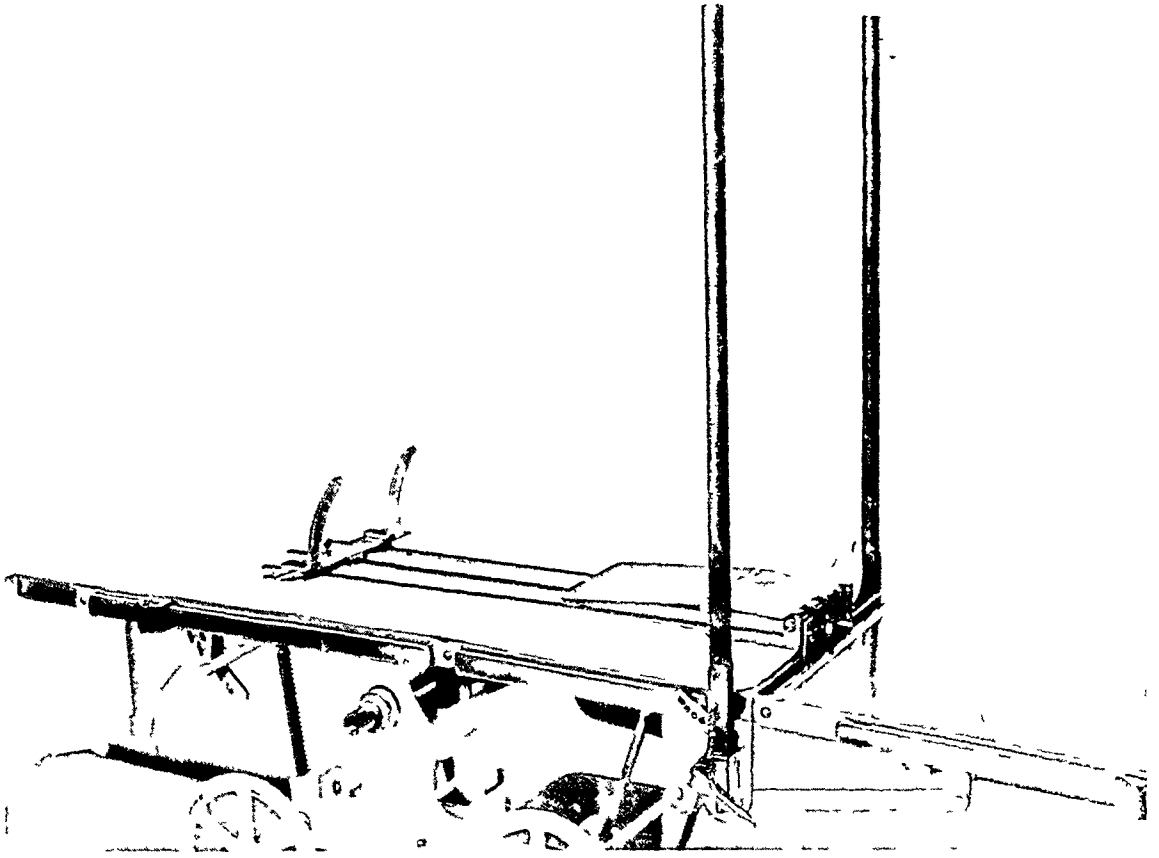


FIG 3 —Elevator flat on the table, leg pieces in upright position, footpiece raised ready for reception of patient

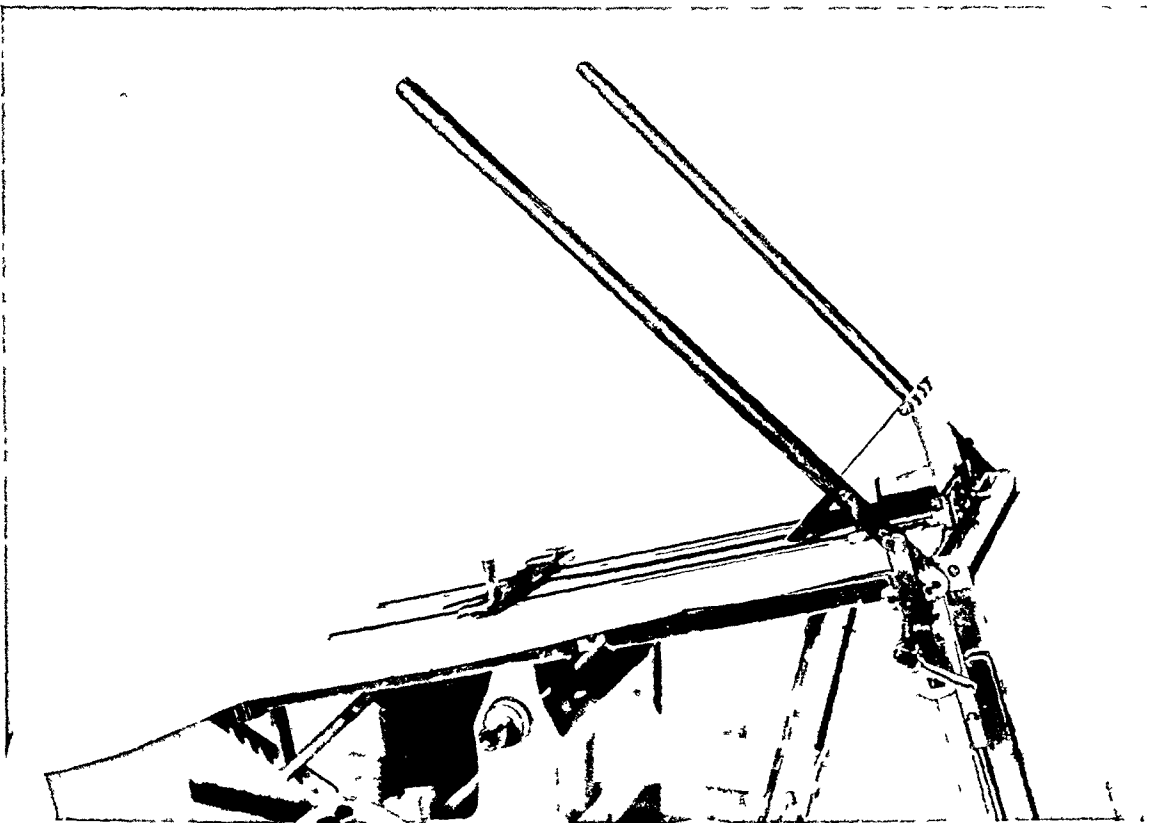


FIG 4 —Showing elevating planes raised and the leg pieces depressed ready for the support of the legs

crank to the screw of the elevator, and raising the elevating planes. Additional elevation may be obtained by lowering the head of the operating table.

The accompanying photographs are illustrative.

This photograph (Fig. 3) shows the elevator flat on the table, with the leg pieces in the upright position. The foot of the table is raised, ready for the reception of the patient.

Figure 4 shows the position occupied by the elevating planes and the leg pieces when the patient is in the elevated position. It will be noticed by

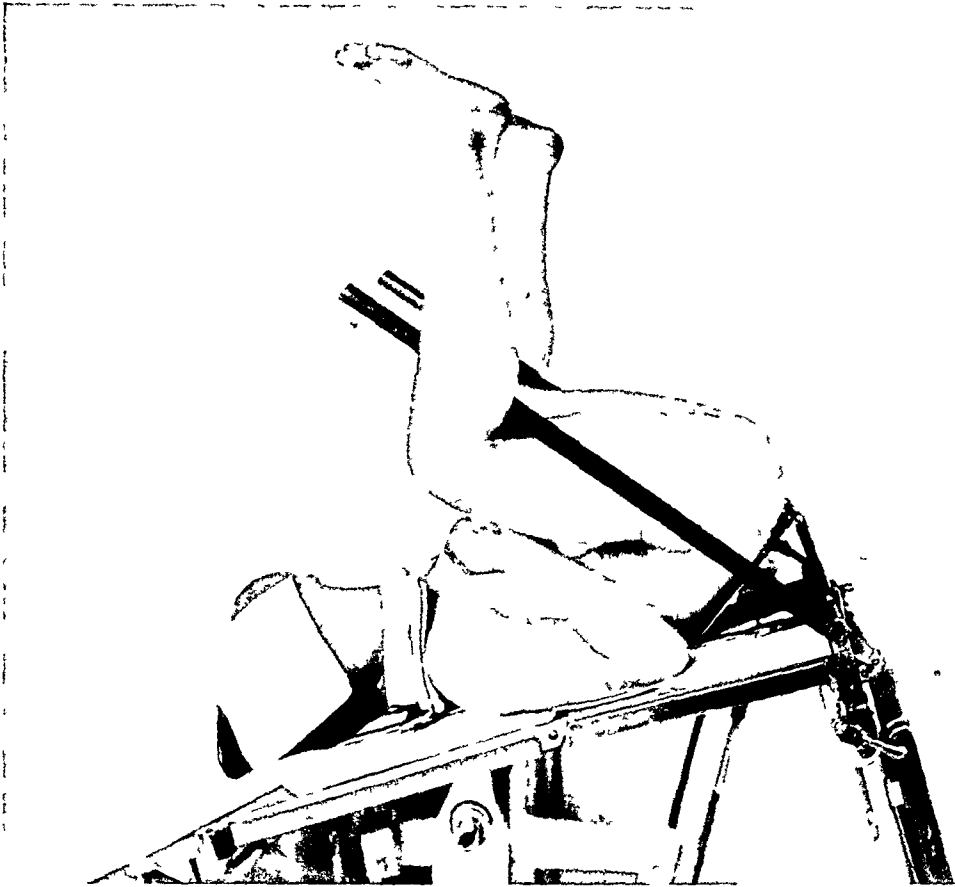


FIG. 5 —The patient in position.

comparing this picture with Fig. 3, that as the elevating planes have been raised, the shoulder braces have advanced a corresponding distance.

The leg pieces are dropped back, and fastened, the footpiece of the operating table lowered, and the head depressed.

Figure 5 shows the patient in position, with the perineum parallel to the floor. Of course, in actual use the leg pieces should be rubber shod, pads should be placed on the elevating planes, and on the shoulder braces. These have been omitted here for clarity of illustration.

While this instrument has been constructed primarily for use in prostatic and seminal vesical surgery, its field of usefulness could readily be extended to rectal surgery, and to gynecological operations through the vagina.

STITCH INTERPOLATION IN ARTERIAL AND VENOUS ANASTOMOSIS

BY CARLETON DEEDERA, M D
OF NEW YORK, N Y

A SURGEON occasionally needs to anastomose arteries and veins when he may never previously have had any experience in this difficult task. In suturing veins there is a tendency for the lumen to be reduced at the line of suture. Avoiding this is even more important than in operations on the small intestine where the same rules of technic are most useful.

Interpolation is a term of higher mathematics and refers here in a single word to the question of how many stitches to take between certain limits and how deep to take them. In general application in surgery the number and depth are inversely proportional.

It can be stated in the form of a rule as applicable to venous suture as follows:

Rule for Stitch Interpolation—The depth of the stitch behind the free margin should be equal to the distance between the stitches.

This means that when the suture is drawn to close the line of repair, the tissue between opposite stitch-holes is double the amount of tissue between adjacent stitch-holes.

The slight increase in mass thus of tissues in opposition is sufficient to exert pressure laterally and thus counteract tendency to constriction of the lumen.

This is a very simple rule and easy to remember. The experiments upon which it is based were done on dogs, monkeys and goats. In dogs as in the human the distance between stitches in arterial anastomosis should be about twice the thickness of the arterial wall. In venous suture the distance between stitches may safely be three times the thickness of the vein wall.

Although it is not so very common that a surgeon has to suture a blood-vessel, when he does, however, it is usually an emergency. It is for that reason that this rule is offered for publication, that it may help as a determining factor in unexpected cases where the surgeon may never have been confronted with the difficulties in the technic of vascular anastomosis.

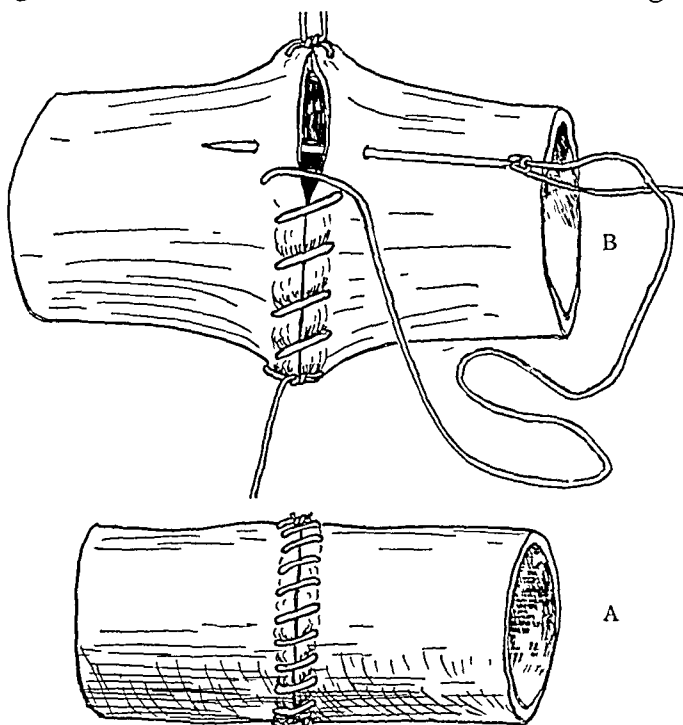


FIG 1—A shows the J B Murphy stitch with arrangement of stitches according to rule for stitch-interpolation. B This drawing was made from a vein about two to three mm diameter. The suture material is a raw silk fibre. Knot in this material is smaller than smallest needle and is a great aid. Tension on silk is equivalent to about one-third its tensile strength.

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting Held October 5, 1925

The President, DR EDWARD B HODGE, in the Chair

DIVERGENT DISLOCATION OF THE METATARSUS

DR ASHLEY P C ASHHURST presented a man, now thirty-five years of age, who was admitted on the night of August 9, 1921, to the Episcopal Hospital, with a recent injury of the left foot while pushing an automobile the machine began to coast, and one wheel rolled against the upraised heel of the patient, the ball of whose foot rested firmly on the ground thus crushing the posterior part of the foot against the anterior (Fig 1) The man felt something give way in his foot, suffered extreme pain, and felt that his foot was more or less crushed. He was put to bed and the foot elevated.

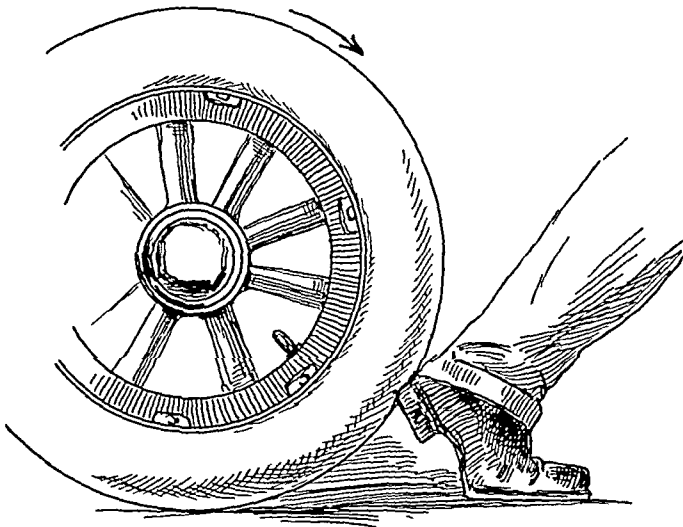


FIG 1 — Mechanism by which a divergent dislocation of metatarsus was produced in a patient thirty-one years of age

There was great swelling the next day, the plantar surface of the foot being convex. There was no tenderness over the malleoli or the leg bones. In the region of the base of the first metatarsal or internal cuneiform bone was a bony projection on the median and dorsal aspect of the foot from displacement of the first metatarsal, and on the dorsum of the foot was a bony projection corresponding to the bases of the third, fourth and fifth metatarsals. The swelling was

too great to determine anything more accurate by palpation, but a recollection of the brilliant study in 1909 by Quenu and Kuss of dislocations of the metatarsus enabled Doctor Ashhurst to make a tentative diagnosis of a dislocation of *divergent type*, which was promptly confirmed by X-ray study (Figs 2 and 3). Quenu and Kuss (*Revue de Chir*, 1909, vol xxxix, p 1, et passim) showed that the foot may be divided into two structural parts of which the main weight-bearing part is composed of the tarsus with the first metatarsal and its phalanges, while the four lateral metatarsals with their phalanges serve merely as a balance. They collected thirty dislocations of the metatarsus, and found that there were two main types (1) that in which the entire metatarsus is displaced laterally and toward the dorsum of the foot (*external dorso-lateral dislocation*) and (2) that in which there is a dislocation of the balancing portion laterally, and of the first metatarsal medially (*divergent dislocation*). Of this latter type, only five cases were

DIVERGENT DISLOCATION OF THE METATARSUS

found in which an uncomplicated divergent dislocation of the metatarsus was present Speed, in his Text Book, refers to four cases subsequently reported The present case makes the tenth

Owing to the condition of the soft parts no attempt at reduction was made for a week Closed reduction under general anæsthesia being then



FIG 2 —Divergent dislocation of metatarsus lateral view

impossible, open operation was done August 16, 1921, under Esmarch anæmia a bayonet-shaped incision was made along the course of the peroneus brevis tendon on the lateral border of the foot, thence medially across the dorsum and thence downward along the interspace between the fourth and



FIG 3 —Divergent dislocation of metatarsus, frontal view

fifth metatarsals The bases of the outer four metatarsals were found luxated dorsally and laterally on the cuneiform bones After elevating the soft parts from the dorsum of the foot, reduction was secured by leverage over a periosteal elevator Reduction was not maintained, however, until after the peroneus brevis tendon (just above its insertion into the base of the fifth metatarsal) had been sutured into the external cuneiform bone A

second (longitudinal) incision was then made along the median side of the tibialis anticus tendon and continued downward over the medial surface of the first metatarsal. The base of the first metatarsal was found riding on the dorsal and median surfaces of the internal cuneiform bone. Reduction was easily secured but persistently recurred until the base of the first metatarsal was sutured to the internal cuneiform, by a double strand of No. 2 chromic gut passed through tunnels bored in the bones. The foot was dressed in plaster-of-Paris in the equino-varus position, as this put least strain on the bone sutures (Figs 4 and 5).

The first dressing was made four weeks after operation, when the plaster



FIG. 4—After open reduction of divergent dislocation of metatarsus

case was removed, and a felt instep pad was worn in the shoe. Seven weeks after operation the patient walked without crutch or cane, and he resumed his work as bricklayer, his total period of disability from the injury was eight weeks. He has now been at work four years and his foot gives him no trouble.

LATE RESULT (FOURTEEN YEARS) OF ASTRAGALECTOMY FOR FRACTURE-DISLOCATION

DOCTOR ASHHURST said that at the meeting of the Academy, October 2, 1911, he had presented a man, then forty-five years of age, whose astragalus had been broken in two and the fragments displaced anteriorly and posteriorly. Owing to the impossibility of reducing the fragments even by open operation the entire astragalus was removed. In June, 1925, this patient, now sixty years of age, was again admitted to the Episcopal Hospital with some medical condition. His foot had given him no disability since the accident except some pain in cold and wet weather. There was motion at the ankle-joint

LATE RESULT OF EXCISION OF ANKLE-JOINT

from 80° to 110° , the foot was stable, in good position, and strong. Within a year of operation he had been able to walk eight miles at a stretch. A skiagraph made fourteen years after operation (Fig 6) shows excessive



FIG 5 —After open reduction of divergent dislocation of metatarsus

bone production from the tibia and os calcis, as well, perhaps as from some minute portions of the astragalus not removed



FIG 6 —Fifteen years after astragalectomy for fracture-dislocation

LATE RESULT (THIRTY-FIVE YEARS) OF EXCISION OF THE ANKLE-JOINT FOR INFECTED COMPOUND FRACTURE

DOCTOR ASHHURST also reported the case of a woman, forty-five years of age, who was seen at the Episcopal Hospital in the summer of 1922. In 1887, when ten years of age, she had been under the care of the speaker's

father, Dr John Ashhurst Jr in the University Hospital, for a compound fracture involving the ankle-joint, with secondary infection. For this an excision of the ankle-joint had been done by the late Professor Ashhurst and though the sinuses had been several months in closing, the patient had had no recurrence of trouble, and had been able to lead an active life for the past thirty-five years, and had no discomfort from her foot. There was shortening of the entire lower extremity, amounting to about 8 cm., requiring her to wear a raise on her sole about 5 cm. high, and the foot itself was about a third shorter than its fellow, and inclined a little to the valgus position. There was motion of about 20° in the ankle-joint, the foot being at right angles with the leg. A skiagraph showed absence of the astragalus with the convex surface of the tibia fitting into a concavity in the calcaneum.

ARTHRODESIS OF THE ELBOW

DR ASHLEY P. C. ASHHURST read a paper with the above title, for which see page 104.

FOOT DISLOCATIONS

DR B. F. BUZBY reported the history of a longshoreman who fell down the hold of a vessel fourteen or fifteen feet and sustained a dorsal and lateral dislocation of the foot through the tarsometatarsal joint, all of the metatarsal bones being involved, except the fifth, which was in position. He was given an anæsthetic and the deformity reduced by the closed method and the foot gotten pretty well back into normal position. He stayed in the hospital for about ten days after that and then went home. His later history is not known.

The second case was that of a man who was loading a freight car when the engine shifted the car and his foot was caught under a steel platform between the freight car and the loading platform. The result was a dislocation dorsally and externally of all of the metatarsals except the fifth, complicated by fracture of all except the fifth. This was reduced by the open method. Post-operative X-ray shows good reduction of the dislocations and fair alignment of the fracture. This was last December and the man now walks around without a cane and without much pain in the foot.

The third case was most unusual. A man was playing golf last November and jumped down from a place about six feet high and says on doing so he was aware that he was about to land in a ditch, and as he fell he gave a lunge forward so as to keep his body at least out of the ditch. When seen by the reporter, not more than an hour after the accident happened, his whole fore-foot was displaced mesially, looking like a congenital club-foot of the varus type.

He had a tremendous amount of swelling. He had a complete dislocation inward of his foot at the mid-tarsal joint. He was taken to the hospital and under anæsthesia the dislocation was reduced. He now is able to play thirty-six holes of golf without rest and says that his function is excellent.

TARSAL RESECTIONS

DR J. T. RUGH in connection with one of the cases exhibited by Doctor Ashhurst, said that the results are entirely in harmony with a number of cases of this kind he had seen recently. Morton advocated extensive resection of the tarsals for the correction of club feet from 1886 to 1894. The rule then was to take out as much of the tarsal and metatarsal as was necessary to overcome the deformity, no matter what the age although more commonly in older patients. About 1894, Wilson reported a large series of these cases.

DISLOCATION OF THE ASTRAGALUS

He had had the privilege of seeing some of the cases done at that time and this astragalectomy done by Dr John Ashhurst reminded him of them and of the changes that are likely to take place. The immediate result of these mutilating operations for the correction of deformities was good, patients walked on them very satisfactorily just as after astragalectomy but when the patients come to the age of forty and forty-five years they are not what is to be desired at all. The secondary changes which take place in the bone after that period of time are at times extremely disabling. Very fortunately however the extensive resection operations were only done over a period of about ten years at the most, and the changes seen about the lower end of the tibia and in the tarsal areas recall the changes which are liable to take place in extensive resections.

ARTHRODESIS OF THE WRIST

DR WALTER G. ELMER called attention to the arthrodesis of the wrist in one of the patients exhibited by Doctor Ashhurst. In children there is some likelihood of a return of motion after this operation has been done. In order to prevent this, he had used a bone-graft from the tibia in several of his cases. After the deformity has been corrected by stretching the contractures and daily manipulation and the hand held in hyperextension upon a splint, a bone-graft is imbedded in the lower end of the radius, the carpal bones and the second metacarpal—extending out to about the middle of the shaft. The hand is in this way firmly ankylosed on the forearm in about 35° of hyperextension. In cases of cerebro-spastic paralysis and of infantile paralysis the hand is sometimes firmly flexed to a right angle on the forearm. In this position, it is of course entirely useless as the child has no power to grasp objects. It is quite surprising to see the extent to which they learn to flex the thumb and fingers and to grasp objects after the hand has been fixed in hyperextension. Not only is there some chance of restoring some degree of function but an unsightly deformity is corrected and the hand placed in a natural and graceful position.

DISLOCATION OF THE ASTRAGALUS

DR EDW. T. CROSSAN presented a woman thirty-eight years of age, who fell out of a second-story window, landing on both feet. This happened on the first of July. She was admitted to the surgical service at the Episcopal Hospital in Doctor Ashhurst's service. In one ankle there was present an antero-lateral dislocation of the astragalus, while in the other the dislocation was upward (Nelaton's dislocation). The reporter did an astragalectomy two days after her admission to the service. She also had a fracture of the fibula. On the left side she had a badly comminuted fracture of the tibia and fibula and just above the external malleolus the astragalus was dislocated upward. On the other side he used a Delbet splint. The woman states that she now has good motion in the left ankle and good motion in the right ankle but not as good as on the left side. The astragalectomy was done on the right side, on the left the Delbet splint was used. The Delbet splint was removed to-day and she has begun to walk around the house a little. She is a heavy woman and it will therefore be a longer time till she recovers.

INFECTED HYDATID DISEASE OF THE LIVER ASSOCIATED
WITH CHOLELITHIASIS

DR E L ELIASON presented a man, twenty-six years old, who was admitted to the medical service of the University Hospital in December, 1924, and February of 1925 complaining of sudden acute pain in the epigastrium and back. Each time his pain was relieved within twenty-four hours and he was discharged. He was admitted again in April with another attack of the same symptoms.

For about three years the patient had noticed epigastric distention and belching after eating. He had several attacks of sharp epigastric pain which radiated to the back, and were so severe as to need morphine for their relief. These attacks were associated with nausea and vomiting and slight fever. The present attack, which began a few days before admission, was like the others, except that at this time he first noticed a yellowness, first of his sclera and later of his skin. His stools were light in color and his urine dark. He had no itching. He felt hot, and weak.

The patient is a Greek by birth, and has lived in America for the past six years. He remembers, as a boy, passing worms by rectum.

When admitted, the patient was deeply jaundiced and writhing with acute epigastric pain. His chest showed a few basal râles, especially on the right side, and there was diminished expansion at the right base. His abdomen was rigid and tender above the umbilicus, much more marked on the right side. A mass was indefinitely palpable in the upper right quadrant which was believed to be a distended gall-bladder.

Temperature, 98.3° – 103° , white blood-cells, 8900. The Van den Bergh test indicated obstructive jaundice. An attempt to drain his gall-bladder by duodenal tube was unsuccessful. No "B" bile was obtained. Pus cells were found in the aspirated duodenal contents.

His abdomen was opened through a right paramedian incision. A markedly distended thick-walled gall-bladder was disclosed. The gall-bladder was opened and one marble-sized stone was dislodged from the beginning of the cystic duct. The common duct was small, and no bile could be aspirated from it. The duct was opened between catgut tension sutures. Thick granular bile-colored material was evacuated from it, streaked with pus and fluid resembling an egg with the yolk and white broken up together. A T-tube was inserted in the common duct and a tube was placed in the gall-bladder.

Two days after his operation he developed a broncho-pneumonia or root pneumonia, more marked on the right side—white blood-cells, 18 000.

On the ninth day after operation his chest signs began to grow less marked. His bile drainage which had been free from both tubes grew less from the gall-bladder tubes. Both tubes were removed by his eighteenth day post-operative and his general condition seemed good. He was free from fever for five days.

Three days later he had a return of fever, with some cough, and pain in the lower right chest. White blood-cells, 15,000. The pain continued and a point of tenderness developed over the right ninth rib in the post-axillary line. There was some oedema of the subcutaneous tissues in the same area. The right diaphragm was shown to be high by X-ray. Beneath this an air contained cavity with a fluid level was seen in the liver on the right side from an inch to an inch and a half beneath the diaphragm.

Four weeks after his first operation the ninth rib was resected in the right post-axillary line. An aspirating needle inserted through the diaphragm into the liver located pus. The wound was packed with gauze. Three

SARCOMA OF THE STOMACH

days later, the liver abscess was opened with a cautery allowing about 8 to 10 fluid ounces of pus to escape. It was noted that several thin-walled cysts escaped, which on examination showed the scolices of the hydatid form of *tænia echinococcus*. Drains were inserted. The drainage was free from his abscess cavity, at first purulent material, later becoming almost pure yellow bile. A very little bile-stained fluid escaped at the abdominal incision. His stools were clay colored.

About two weeks later, the tube was removed from the abscess drainage tract and his stools began to show bile pigment. The draining wounds rapidly healed. His stools gradually showed more and more bile pigments.

He was discharged from the hospital twenty-four days after his abscess drainage, with both wounds healed and complete relief of jaundice. He has gained 23 pounds.

DOCTOR ELIASON remarked that it had been stated by others that it is extremely hard to keep these cases permanently closed, they will break down from time to time. Many articles speak of the wounds as being infected by the *echinococcus*.

As soon as he took out the tube in this case, the bile ceased coming out through the fistula and went the normal way. When he first examined this man he could find nothing wrong with the common duct and on putting a needle in it found no bile. He was ready to close him up, but decided to open up the common duct because of the jaundice, and found it filled with material, the like of which he had never seen before. He realized afterward that it was the same as the fluid found in the liver abscess. It looked greatly like a bad egg.

SARCOMA OF THE STOMACH—GASTRIC RESECTION UNDER LOCAL ANÆSTHESIA

DR E. L. ELIASON presented a man, aged fifty-eight years, who was admitted to the Service "C" of the University Hospital complaining of post-prandial pains, distention, pyrosis, and occasional vomiting, a movable abdominal mass, and loss of weight and strength.

His symptoms dated from January, 1925, when he first began to notice pain following meals, occasional vomiting and marked abdominal distention. Three months later he began to notice a mass above his umbilicus which has gradually grown larger. He has become somewhat constipated. At times he noticed that stools were black and tarry, especially during past three months.

Since January (in eight months) he has lost 35 pounds in weight, and he noticed that he was losing his usual strength and vigor. When admitted the man showed marked emaciation. His lungs were clear, and his heart was regular with fairly forceful sounds. The abdomen was scaphoid and thin-walled. Just above the umbilicus was a firm, nodular mass. It was freely movable over the entire upper abdomen, and could be lifted up in the fingers. The mass was not tender. The liver was palpable about three fingers' breadth below the umbilicus on deep inspiration. Its edge was firm and no nodules were distinguished.

He was operated on September 2, 1925, under local anæsthesia. The upper abdominal wall was infiltrated with $\frac{1}{2}$ per cent novocaine solution and a right rectus incision was made, disclosing a firm nodular mass about the size of a grapefruit, which involved the pyloric end of the stomach and extended to the duodenum just distal to the pylorus. His liver was free from any

visible or palpable metastatic involvement and there were no nodules palpable along the lesser curvature of the stomach. A resection of the mass was done after ligating the mesentery in sections. No discomfort was experienced during the resection except when traction was made on the gastro-hepatic omentum, and this was immediately relieved by infiltration with $\frac{1}{2}$ per cent novocain solution. The duodenal stump was inverted, and a gastro-enterostomy was performed by the Polya method. The loop was brought anterior to the colon because of a short transverse mesocolon. His wound was closed in layers without drainage.

The convalescence was marred only by a slight infection at the site of one hypodermochysis needle. He had no vomiting or nausea. Water was given by mouth, 36 hours after his operation. He was allowed out of bed on the sixteenth day of his operation, and was discharged on the eighteenth with a well-healed wound and no symptoms. He has since gained ten pounds.

The specimen removed at operation showed very little ulceration of the mucosa, but surrounded the pylorus and the adjacent stomach wall in a hard mass, forming a firm funnel.

On microscopic examination, the tissue was markedly cellular, divided into irregular nests by fibrous bands. It is impossible to recognize any of the stomach layers. At the periphery of the section, there are large deposits of mucoid material, with a few partially degenerated cells. The cells which make up the greater part of the section are round, stain well, and in many instances show vacuoles. The general arrangement, the cell structure and shapes are all indicative of sarcoma. Diagnosis—round-cell sarcoma with mucoid degeneration.

FECAL FISTULA OCCURRING IN A LARGE INCISIONAL HERNIA

DR JOHN SPEESE reported the history of a man fifty-two years of age, two hundred and sixty pounds in weight, who was admitted to the Presbyterian Hospital, July 29, 1925, for closure of a fecal fistula occurring in a hernia of the abdominal wall. The patient states that he had a tuberculous abscess in the left groin, which was opened twenty-two years ago. There was profuse drainage for eight months when the sinus closed and a year later a hernia developed in the scar. The hernia progressively increased in size, was irreducible, but at no time caused any discomfort. He has worn a combination truss and belt over the hernia which measures approximately 20 x 15 cm. Several days before his admission to the hospital, evidently due to some irritation of the belt, the skin first became inflamed and then ulcerated. This was followed by a discharge of gas and fecal matter in the centre of the ulcerated area. Active peristalsis was seen and felt in the hernia and the skin surrounding the fistulous opening was dirty and ulcerated in appearance. Local antiseptic measures were used in order to overcome the skin infection before operating on the fistula, but owing to the constant escape of feces such measures were of no avail. Two weeks after his admission to the hospital the fistulous tract in the skin was excised and a minute opening in the small intestine was located. After mobilizing the bowel the fistula was closed by a double row of No. 1 chromicized catgut sutures and the reflected skin sutured over the bowel. Following this operation there was no leakage of intestinal contents and the infection of the skin subsided sufficiently to justify an operation for closure of the hernia. After excising the previously infected skin, the sac was opened by dividing the fascia which covered the hernia for the most part. The protrusion did not involve the inguinal canal and the abdominal muscles were so atrophied and so retracted that they could not be utilized in the closure. The coils of small intestine contained in the sac

RUPTURE OF AORTA WITH HEMOPERICARDIUM

were densely adherent to one another and to the peritoneum, from which they were detached with difficulty. After reduction was accomplished, it was found that a firm closure of the opening could be secured by overlapping the fascia. The latter, although strong in the central part, was weak and attenuated at both extremities, and here was reinforced by sutures removed from the fascia lata.

The patient made a satisfactory convalescence, although healing was retarded by a superficial infection which did not interfere with healing of the fascia or prevent a cure of the hernia.

RUPTURE OF AORTA WITH HEMOPERICARDIUM

DR JOHN SPEESE reported the following case history and exhibited the specimens removed at autopsy. The patient, fifty-eight years of age, was admitted to the Presbyterian Hospital, September 27, 1925, complaining of severe upper abdominal pain. This began twenty-four hours previously and was sudden in onset. The pain began about the level of the costal margin, passed up the sides of the chest to the back of the neck, and was followed by symptoms of shock. His physician gave him three hypodermics of morphine before relief was secured. The following morning he vomited after eating. The pain then recurred, remained localized to the upper abdominal region, was very severe, constant in character, and was followed by persistent nausea and vomiting. He was sent to the hospital with a diagnosis of intestinal obstruction.

On admission the upper abdomen was slightly tender and rigid. Temperature and pulse were both normal. The leucocytic count 15,000. Urine contained many casts and albumen. The patient was admitted late in the evening, passed a fairly comfortable night, and the following morning when examined had little or no pain or tenderness and did not seem acutely ill. Shortly after the examination the severe pain returned and the patient, while reaching for a glass of water, fell back in bed and died.

The autopsy revealed a pericardium markedly distended with soft dark blood clots. The heart was greatly enlarged due to the left ventricular hypertrophy. The arch of the aorta was dilated by an early saccular aneurysm. At a point 2.5 cm above the aortic cusps, there was an irregular jagged tear 4.5 cm in length involving the wall of the aorta and opening into the pericardium.

The pyloric end of the stomach was remarkably thickened, due to a tremendous hypertrophy of the muscular coats which resulted in marked narrowing of the lumen. There was no evidence of duodenal or pyloric ulcer or other pathologic process which could account for the hypertrophy, which resembles greatly the congenital hypertrophic form encountered in children. The patient had not complained of any gastric trouble or pain prior to the onset of the present attack.

The specimens were shown and the history reported because of the severe nature of the symptoms suggesting upper abdominal disease and because of the presence of such an unusual form of benign pyloric stenosis in an adult. The cause of the latter was not determined, whereas a previous syphilitic history accounted for the disease of the aorta.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY

Stated Meeting Held October 14 1925

The Vice-president, DR FRANK S MATHÉWS, in the Chair

CYST OF EXTERNAL SEMILUNAR CARTILAGE

DR MORRIS K SMITH presented a man, thirty years old, who entered St Luke's Hospital in May, 1925. He developed a swelling of the outer side of the right knee four years before. There had been no trauma or other possible etiology that he could recall. At first he had no symptoms, then the knee began to pain. Going up and down stairs became particularly difficult.

Examination revealed a thin man, normal except for the local condition. On the outer side of the right knee, just at the joint level, was a rather firm mass about $1\frac{1}{2}$ inches in diameter. It was not attached to the skin. Active flexion of the knee was limited to 90 degrees, extension was complete. The right thigh was distinctly atrophied, measuring 1 inch less than the left. X-ray examination of the knee was negative.

At operation the tumor was found to be tensely compressed beneath the fascia and attached to the lateral aspect of the semilunar cartilage by fibrous tissue. In cutting it away, a yellowish discoloration of tissue was noted, similar to that found in the tumor itself, suggesting that the disease may have extended into the cartilage,

although no other evidence of this was noted. On section (Fig 1) the growth was made up of multiple cysts with gelatinous content. There were areas of yellowish coloration. The pathological diagnosis was fibroma of knee-joint capsule.

From the day of operation the patient stated that he felt relief. He left the hospital on the eleventh day, and when interviewed recently five months later, reported the knee to be well. There was no opportunity to examine him at this time.

The reporter stated that Dr Alan D Smith of the New York Orthopaedic Hospital had described to him a cyst of the external semilunar cartilage which he removed. Pheinstér's article, "Cysts of the External Semilunar Cartilage," in the *Journal of the American Medical Association* for March 3, 1923, p 593, describes two cases which tallied so closely with the present one that it seems to represent the same condition.

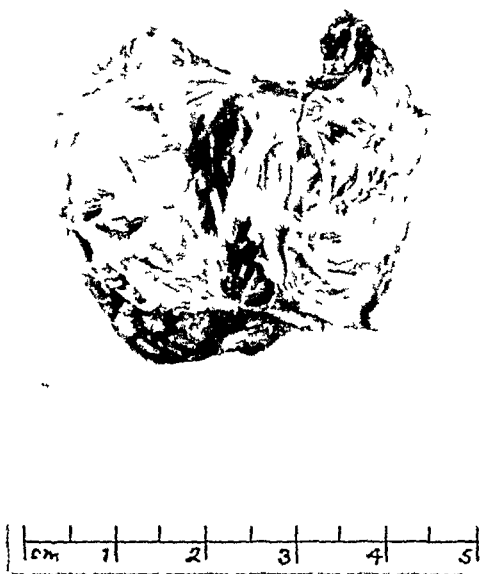


FIG 1 —Tumor removed from the lateral aspect of the external semilunar cartilage of R. N.

CHRONIC SYNOVITIS OF THE KNEE-JOINTS

Phemister's cases are, he states, the first reported in American literature. He collected thirteen from foreign literature. In both of Phemister's cases, the cartilage was involved and was removed. This should be done, as of four cases where the cartilage was left in, in two there was a recurrence, necessitating a later excision.

The man at the time of his presentation before the Society showed a prominence suggesting a recurrence. This is further evidence that the condition originated in the cartilage and it seems probable that he will sometime later have to have it removed.

DR ALAN DEFOREST SMITH (by invitation) described the case of a young woman with a small swelling on outer side of the knee. At operation, it was found to extend beneath the fascia and was adherent to the lateral semilunar cartilage. This cartilage was removed and sectioned and was found to contain multiple cysts filled with a colloidal material. The pathological examination showed that it resembled the ganglia which are found attached to the capsule of the wrist or the tendon sheath about the wrist. Sections showed a gradual transition from fibro-cartilage to fibrous connective tissue with areas of degenerated tissue which were amorphous in places and then became fluid. The cyst formation was still in progress. Doctor Clarke of the College of Physicians and Surgeons thought that both grossly and histologically it resembled the ganglia which are often found about the wrist.

CHRONIC SYNOVITIS OF THE KNEE-JOINTS

DR MORRIS K. SMITH presented a child, who in April, 1923, when seven years of age, was first found to have fluid in the right knee-joint. There was a history of trauma to the knee five days before the appearance of swelling. She was seen only twice in the next two months. At the end of this time she reappeared with a swelling of the right knee, said to have occurred the night before. She was under observation for another two months, during which time the fluid was aspirated and the knee treated by a supporting bandage. Guinea-pig inoculation of the fluid was negative. X-ray was also negative. When last examined the right knee measured 1 cm. more than the left. She was next examined in December, 1924, seventeen months later. At this time 100 c.c. of clear straw-colored fluid was aspirated. Guinea-pig inoculation was again negative. Another X-ray was also negative, except for an exostosis in the tibia posteriorly well below the joint level, which did not seem like an etiological factor. Von Piquet was positive. She was observed throughout the winter. There was complaint of pain in the knee and thigh and in March a very slight temperature having been obtained twice and the local condition remaining little changed, she was referred into the hospital for an exploratory arthrotomy. This was not done, however, as the knee had improved considerably before she was ready for operation. Instead a plaster case was applied. She was last seen in June, 1925. During the winter while the right knee was under treatment, a little fluid was once noted in the left knee.

October 3, she was found to have been perfectly well during the summer. had no pain and could run and play as well as ever. On examination there was fluid in both knee-joints. Aside from the local condition the child's health has been excellent. She has never had rheumatism. Her father has had tuberculosis. Both parents have negative Wassermann reactions.

In this case tuberculosis cannot be ruled out, although it seems unlikely in view of the two negative guinea-pig inoculations, the present bilateral involvement and apparent recurrent character of the affection.

Lues had not been ruled out by the therapeutic test or Wassermann on

the patient, although negative Wassermanns in the parents and absence of other stigmata have made it seem unlikely.

It is possible although it does not seem very probable that it may belong to the condition of intermittent hyarthrosis. No established periodicity has been observed in this patient however. In a case reported by Nielson in the *Journal of the American Medical Association* February 18, 1922 there was for some time irregular appearance of the synovitis before a regular cycle set in.

Chronic synovitis is an unsatisfactory diagnosis. The original trauma to the right knee does not seem to have been of great importance. There have been long periods of remission of symptoms although it is not known whether the fluid has ever completely cleared up.

BLAIR'S OPERATION FOR CANCER OF THE TONGUE

DR. CLARENCE A. McWHILMIS presented a man of sixty-three whom

he operated upon January 12, 1924, for cancer of the floor of the mouth. The man noticed for four months an ulcer size of a half-dollar under the right forepart of the tongue. The ulceration extended to the midline and over to the alveolus. There were a few indefinite enlarged nodes palpable in neck under chin. Wassermann was negative. The patient and specimen were presented with the object of bringing out the thoroughness of Blair's operation, together with its safety as compared with other procedures, also the method of dealing with adjoining bone.

On January 10, 1924, a preliminary tracheotomy was done under local anaesthesia. Two days later the excision (Blair) of the tongue was done successfully.

FIG. 2.—Blair's operation for epithelioma of tongue size of half dollar. Specimen consists of entire tongue with all its intrinsic muscles lower $1\frac{1}{2}$ inches of both parotids, submaxillary and sublingual glands with the intervening fat, areolar tissues and their contained lymphatic nodes all removed in one continuous piece.

under colonic anaesthesia (Gwathmey's method). Incision extended from one ear down and forward across the median line below the hyoid bone to a corresponding point on the opposite side. The skin was dissected up off the platysma which was removed with the block-dissected tissues in one piece, including both lower poles of parotids, all the areolar tissue including nodes, both submaxillary glands and the entire tongue with its intrinsic muscles. Below, the digastrics were isolated. The facial arteries

Fig 3—From Kuttner Lymphatics draining tongue

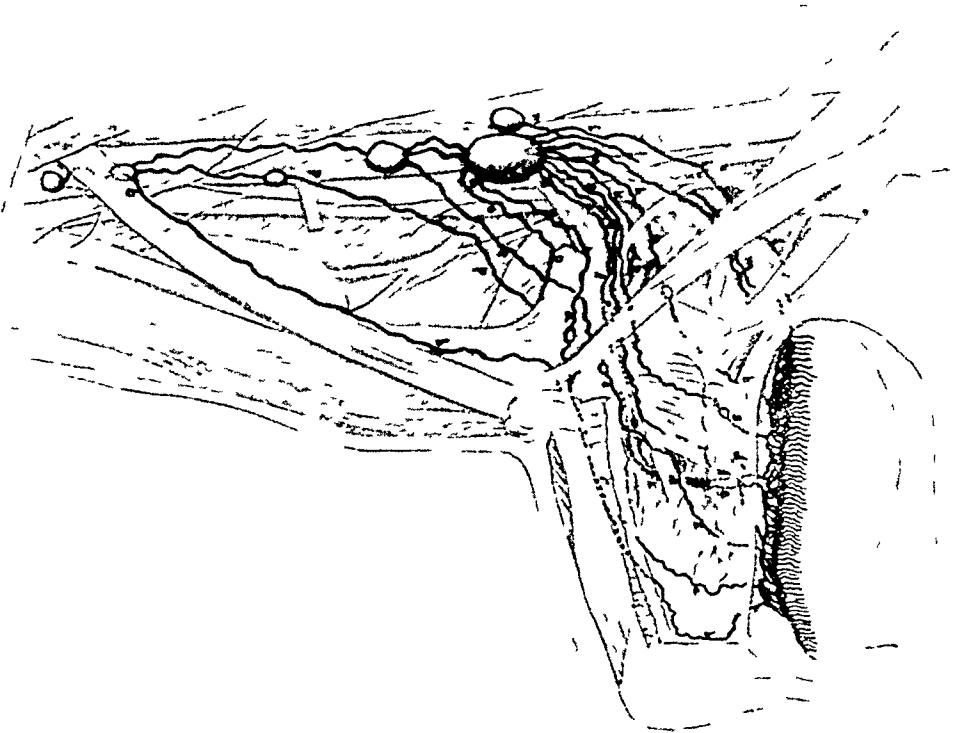
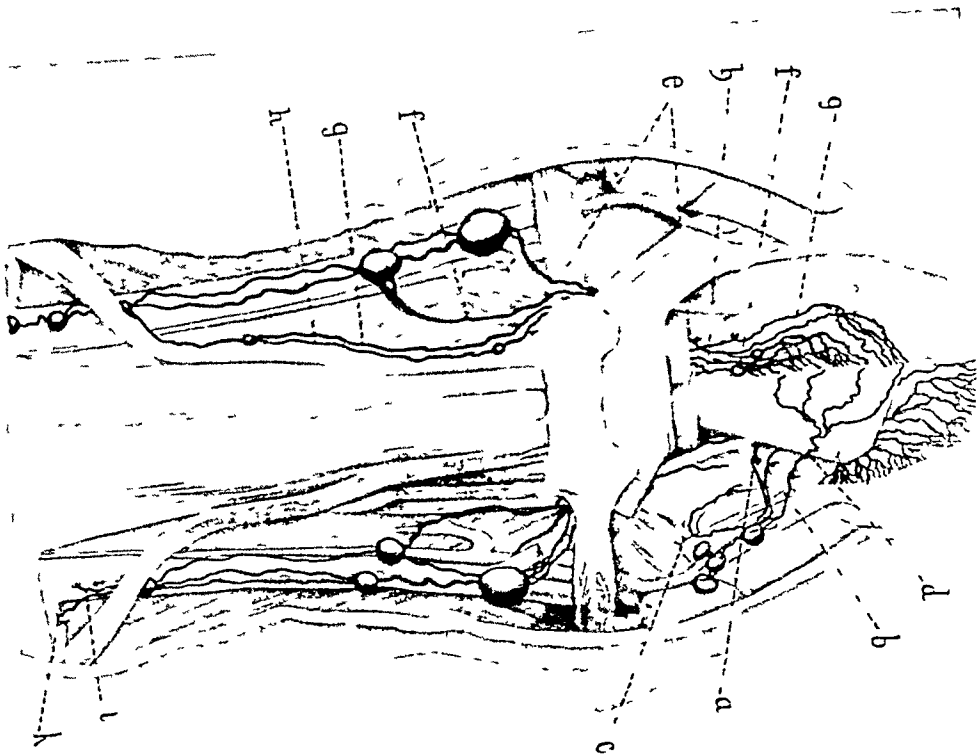


Fig 4—From Kuttner Lymphatics draining tongue



low down were tied. Just below the front of the outer portions of the digastrics both lingual arteries were exposed and tied by separating the muscular fibres of the hyoglossus muscles. The fascia above the lower edge of the lower jaw was divided all around the jaw, and all the tissues were separated downward from the lower jaw. Beginning at the symphysis pubis, the anterior bellies of the digastrics, the geniohyoids, the geniohyoglossi and the mylohyoids were all divided with a knife closely hugging the bone. The bone adjacent to the ulcer was then thoroughly cooked with a red hot soldering iron. Bone is not easily affected with cancer and experience has shown that unless the cancer has actually grown into the bone, the hot iron will kill enough of the bone

to prevent local recurrence there. The tongue is then drawn out below through this wide neck opening and the subsequent excision will depend upon the location of the growth, the pillars being clearly in view, in necessary cases these and the tonsils can also be removed with the tongue. Before dividing the tongue, the sternomastoid should be dissected out, dividing the spinal accessory nerves, to accomplish good exposure, and the nodes and areolar tissues, beneath the upper parts of the sternomastoids, should all be removed, being attached to and being facilitated by the division of the parotid, $1\frac{1}{2}$ inches from its lower extremity, which is drawn down and forward. Finally the tongue muscles are divided just above the

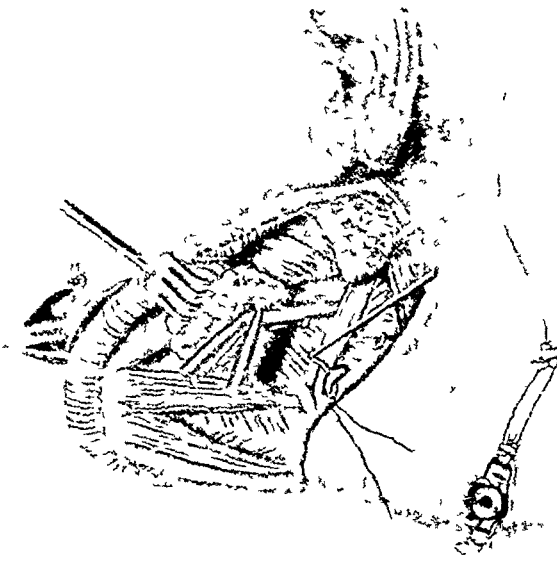


FIG. 5—Shows the submaxillary gland of the left side drawn forcefully upward and the facial artery caught and ready to be cut and ligated as it enters the gland. The lingual artery is shown drawn out through a separation between the fibres of the hyoglossus muscle ready for ligation. (Blair)

hyoid bone and the base of the tongue divided transversely. The entire specimen is thus removed in one piece. Before closing the external wound, a large catheter is passed through one nostril, being guided past the glottis by a finger in the mouth. The external wound is closed without exterior drainage, but lateral drainage down to the secreting parotids is advisable. The cavity of the mouth is packed with sticky balsam Peru gauze. The tracheal tube is retained as long as necessary, gradual attempts should be made to swallow until no fluids go down the glottis, feedings being done meanwhile through the nasal catheter. The reporter had expected to clear out the lower cervical nodes of both sides at a subsequent operation, but the man refused to allow him to do this. Upon learning that the ulcer was epithelioma but with only hyperplasia of the upper nodes, he did not insist upon a second operation. A sinus developed subsequently in the neck which led up to dead bone. A large sequestrum developed and this took eight months to loosen and come away.

This cooking treatment of the bone is much less uncomfortable for the patient than a resection and seems just as curative. Horsley says "Blair's operation will probably replace other operations for advanced cancer of the

BLAIR'S OPERATION FOR CANCER OF THE TONGUE

tongue" Its safety has appealed to the author since he has performed four such operations for advanced cancer of the tongue without a death. Theoretically, one should remove the lymphatics on each side of the neck from the clavicle upwards, doing the procedure in two stages removing the tongue and the lymphatics to just below the digastrics at the first operation and the two sides of the neck at the second stage.

Bloodgood (*J A M A*, July 16, 1921, p 220, and also the same, August 15, 1925, p 537) has written very fully his experience of thirty years with cancer of the tongue. The situation with this lesion is the same as with cancer of the breast. The prognosis in each depends on the involvement or

not of the lymphatic nodes. In cancer of the tongue *without* involvement of the nodes, 62 per cent (Bloodgood) will be alive five years after operation, but with involvement of the nodes only 10 per cent will be alive five years. In cancer of the breast about 60 per cent will be alive after five years without involvement of the nodes, while with node involvement only 20 to 30 per cent will be alive five years after the operation. Radium may at times favorably affect the local tongue lesion, but Bloodgood says "I have been unable to find any evidence that Rontgen-rays or radium have accomplished a cure when the nodes are involved." Doctor Bloodgood also says "I have concluded that the routine complete excision of the nodes of the neck for patients with

early cancer of the tongue is not justifiable by the evidence." The fallacy in this argument is that one can never tell when the nodes are involved palpation from the outside being notoriously unreliable. Hence the author believes that the only safe rule to make, considering the seriousness of the lesion is to always excise the nodes of the neck when there is a cancer of the tongue never mind how small the lesion is, despite negative palpation of nodes.

The neck from the outside is not drained in these patients because it is necessary to prevent the formation of a fistula. There is no drainage in front. The cavity in the mouth left by the removal of the tongue is packed from inside only.



FIG 6—Specimen from patient two after the Pathologist had finished with it. Ulcer not apparent, owing to curve over tongue. Shows extent of lymphatic area removed in one piece.

NON-DESCENT OF TESTICLES

DR A V MOSCHCOWITZ presented a man, twenty-two years of age, upon whom he operated for a right undescended testis about six months ago. The testis is now well down in the scrotum and apparently of normal consistency, and of a size which is not smaller than an abnormally placed testis usually is.

The reporter said that a number of years ago he wrote an article describing the pathology and treatment of undescended testis. At that time he was very much inclined to advocate the Bevan operation, going even to the extent of dividing the spermatic vessels. His primary results were excellent. Subsequently Doctor Moschcowitz attempted to reexamine these patients at late intervals, and while he found some results that were excellent, he found in others in fact the greater number of them, a very marked atrophy, even to a complete disappearance of the organ. As this could be ascribed only to a complete severance of the vascular structures, this method was abandoned by him. Since a number of years Doctor Moschcowitz has therefore proceeded in the following manner:

The testis is liberated of all the fascial structures as advocated by Bevan. If this is not sufficient to permit an easy transplantation of the testis the internal oblique and transversalis muscles are separated in the upper part of the incision after the method of McBurney. The spermatic vessels are now searched for in the retroperitoneal space and liberated upwards even as far as their origin from the aorta and downwards as far as the inguinal canal. When this has been accomplished there is usually no difficulty in transplanting the testis into the scrotum. He has operated a number of cases by this method with uniformly excellent results.

DR FENWICK BECKMAN expressed his interest in this case because it was the first case, of an adult, he had seen operated on in this manner, for undescended testicle. Formerly he had been doing the Bevan type of operation on children, but had almost invariably had a resulting atrophy of the testicle.

Dr Charles Mixer reported in 1924 a series of cases operated upon by the method Doctor Moschcowitz described, and since that time Doctor Beckman said he had been following the same technic. This operation produced excellent results as the blood supply to the testicle was not disturbed and if properly done there was no difficulty in getting the testis down into the scrotum. The difficulty of the technic lay in separating the vessels from the thin hernial sac, but as soon as this was done there was little trouble in separating them from the posterior surface of the peritoneum where the lengthening to the cord was obtained.

DR FRANK S MATHEWS said that it was his opinion that the Bevan operation in children would very frequently be followed by atrophy of the testis. Further, he wonders whether there is any evidence that a testis retained in the abdomen will become spermatogenic on transplantation to the scrotum.

DOCTOR MOSCHCOWITZ, in closing the discussion, said that the operation is rather hard, but he had succeeded in doing it and others ought to succeed, for it should be done. He did not believe it was ever followed by any atrophy. As far as the spermatogenesis was concerned this would be hard to prove.

BLEEDING GASTRIC ULCER

For a long time, whenever he operated on such a case, he always took a small specimen for microscopical examination and in the majority of instances the laboratory reported absence of spermatogenesis. In the literature the statement is made that there is no spermatozoa but that they have a large number of Perdoli cells which go toward the creation of secondary sexual characteristics.

DUODENAL ULCER FOLLOWING GASTRO-ENTEROSTOMY

DR ALLEN O WHIPPLE presented a man, aged sixty-nine at time of operation, who was operated upon at the Presbyterian Hospital by Doctor Brewer, in January, 1917.

A large mass in region of the pylorus was found adherent to liver and gall-bladder. It was hard, indurated, infiltrating, and was believed to be a carcinoma. Posterior gastro-enterostomy was done.

The patient has been followed for ten years. He has had no digestive disturbances of any sort, he has been free from pain and has maintained his weight. The diagnosis of carcinoma was changed to ulcer of the stomach five years ago.

X-rays taken in May, 1922, seven years later, showed no irregularities or filling defects of stomach or pylorus. The duodenum appeared somewhat irregular about an inch from the pylorus, but it appeared elastic. No evidence of gastric ulcer or carcinoma was made out. The stomach emptied itself both by the pylorus and the gastro-enterostomy.

Last follow-up visit was on November 14, 1924. He then had no digestive disturbances of any sort, no pain after meals, was eating three meals a day regularly.

Gastric analysis made October 13, 1925, was as follows: Total acidity, 70, free HCl, 57.

BLEEDING GASTRIC ULCER SUBTOTAL GASTRECTOMY

DR RICHARD LEWISOHN presented a man, fifty-five years old who was admitted to Mount Sinai Hospital, June 8, 1925. He had complained of epigastric distress for three years, the pains usually occurred one-half hour after eating. Frequent vomiting for one and one-half years. Typical remissions, lasting for several months. Patient had lost twenty pounds during the last month. He had a slight hæmatemesis with dizzy spells during the last week before his admission.

X-ray examination showed a marked penetration on the lesser curvature of the stomach at the recumbent angle. The duodenal bulb showed a persistent irregularity. Small residue after six hours. The abnormalities noted were (1) penetration (in view of patient's age carcinoma ought to be considered), (2) irregularity of the duodenal bulb, probably due to a duodenal ulcer. The Ewald test-meal showed free HCl 22, total acidity 29.

While under observation in the hospital the patient vomited bright red blood, his pulse became very small, the stool showed blood. However he reacted quickly from this hemorrhage and did not require a transfusion of blood. The hemorrhage recurred five days later (June 16) the hemoglobin dropping from 75 to 58.

At operation (June 17) a large crater ulcer with marked inflammation of the surrounding tissues was found high up on the lesser curvature. The pylorus and duodenum were normal.

The gastric artery was tied high up on lesser curvature. The finger was inserted into the retrogastric space and adhesions were separated. The gastrocolic omentum was divided below the epiploic arch. The pyloric artery was divided. Clamps were then applied, the upper one about one and one-half inches above the ulcer and the other one below the ulcer in order to resect as close to the ulcer as possible on account of the high location of the ulcer. The stomach wall was then divided about three-fourths of an inch below the upper clamp carefully catching the vessels running in the submucosa. The upper end of the divided stomach was protected and drawn aside. Using the remainder of the stomach as a tractor, the duodenum was dissected free. The duodenum was then cut across at about the middle of its first portion and closed in three layers. The upper end of the stomach was then exposed, vessels tied off, and the upper angle sutured for a distance of two inches. A loop of jejunum close to the foramen of Treitz was brought up, passed through an opening made in the transverse mesocolon and placed alongside of the lower angle of the stump of the stomach. The edge of the transverse mesocolon was sutured to the posterior wall of the stomach and an end-to-side gastro-enterostomy was performed. The upper angle of the stomach was inverted by a second layer. The edge of the transverse mesocolon was sutured to the anterior wall of the stomach. The abdomen was closed in two layers and a drainage tube placed into the retrogastric space.

The specimen showed three-fourths of the stomach and the first part of the duodenum, containing a large penetrating ulcer of the lesser curvature, with a crater the size of a twenty-five cent piece. A vessel rose for one-quarter of an inch from the floor of this ulcer. Microscopical examination showed the ulcer to be benign. Ewald test-meal taken July 5 showed free HCl 0, total acidity 15.

The patient made an uneventful recovery and left the hospital on June 6.

The patient has gained 27 pounds during the last three months.

X-ray examination (October 10) shows a normally functioning stomach.

DOCTOR LEWISOHN stated that patients with profuse gastric hemorrhages should not be operated on immediately, as they are very poor operative risks. However, patients with moderate hemorrhages, as the case just presented, should be subjected to a radical operation at an early date in order to establish a permanent cure and to safeguard them against a subsequent profuse gastric hemorrhage which may prove fatal.

JEJUNAL ULCER PARTIAL GASTRECTOMY

DOCTOR LEWISOHN presented a man, forty-six years old, upon whom he had operated at Mount Sinai Hospital in 1918 for a duodenal ulcer. The patient had gastric symptoms for five years, occurring two hours after meals and relieved by food. A duodenal ulcer was found and a retrocolic suture gastro-enterostomy, combined with a pyloric exclusion, was performed.

He was readmitted to the hospital on May 20, 1925, with the following history. He had been free from symptoms for two years. Since then, though with marked remissions, his pains had recurred. He had sour eructations and occasional vomiting. No hæmatemesis.

X-ray examination (May 22). With the ingestion of the barium mixture, the food after a delay of a few moments started to pass through the stomach rather slowly. Situated in the jejunum, about one and a half inches from the stomach was a persistent patch of barium, half-moon in appearance, which measured about three-fourths of an inch in diameter. This had the appearance of a pocket. Gastric tone was good, the peristalsis was increased. The

GASTRO-ENTEROSTOMY AND GASTRIC ACIDITY

duodenal bulb was fairly well outlined and an irregularity was seen at the base near the pylorus, which is probably the site of an old ulcer. Gastric motility was delayed, showing a small residue after three hours. Ewald test-meal: free HCl 70, total acidity 85.

Operation, May 23, 1925. A jejunal ulcer was found just beyond the stoma. The ulcer was penetrating and adherent to the transverse mesocolon. The gastro-enterostomy stoma was not involved. The pyloric exclusion had partly opened, admitting one finger. A scar (site of a healed ulcer) was noticed on the anterior surface of the duodenum.

Ligation of the gastric artery and of the left epiploic. The greater omentum was divided between clamps for a short distance, when dense adhesions posteriorly rendered it inadvisable to proceed further. The pyloric artery and right gastro-epiploic were then ligated. The duodenum was cut across and inverted with three layers.

The stomach was cut across just beyond the reentrant angle and the intrinsic vessels were caught. The stomach was now attached only at the stoma. The stoma was then divided. Because of dense adhesions of the base of the ulcer to the transverse mesocolon (base really formed by transverse mesocolon), the jejunum was cut around the margin of the ulcer. Attempt to infold the ulcer failed. It was touched with tincture of iodine.

The defect in jejunum was closed in the usual fashion in two layers. The upper end of the stomach was closed and a typical Hofmeister anastomosis was performed, using a loop of jejunum distal to the old stoma. The margins of the mesocolon were sutured to the anterior and the posterior wall of the stomach. The abdominal wall was closed in two layers and a tube inserted into the retrogastric space.

The patient made an uneventful recovery.

June 10, Ewald test-meal: Free HCl 0, total acidity 30.

He was discharged June 11. He is well and has gained eight pounds since the operation.

X-ray examination (October 12) shows a normally functioning stoma.

DOCTOR LEWISOHN stated that partial or subtotal gastrectomy was the logical procedure in dealing with gastrojejunal or jejunal ulcers, as local excision of these ulcers was followed by recurrences in a large percentage of cases.

FAILURE OF GASTRO-ENTEROSTOMY TO EFFECT A DECISIVE REDUCTION IN GASTRIC ACIDITY

DR RICHARD LEWISOHN read a paper with the above title, for which see page 925, vol lxxxii, December, 1925.

DR ALEXIS V MOSCHCOWITZ said he could not absolutely agree with all of the deductions of the paper. It appeared to him that the paper being entirely of a medical nature, Doctor LewisoHN attempts to draw general surgical deductions and indications. One or two glaring errors have certainly crept in, for instance, the presence of an anacidity in some of the cases of sleeve resection, and yet the so-called acid-producing area and the ulcer-bearing area was not even touched.

DOCTOR MOSCHCOWITZ, particularly in duodenal ulcer is accustomed to do a very simple posterior retrocolic gastro-enterostomy with a very simple pyloric exclusion and thus far he has been very well satisfied with the

ultimate result and, what is more important the patient is also satisfied. Once in a great while a gastrojejunal ulcer is encountered, but this occurrence is so rare that it is not a sufficient indication to change his method. As a matter of fact, it appears to Doctor Moschcowitz rather remarkable that there should be such a change in the views regarding the curability of gastric and duodenal ulcer. While Doctor Lewisohn claims a cure by gastro-enterostomy in only about 50 per cent of the cases, it is generally conceded not only by surgeons, but even the most thorough internists, who are only too prone to check up surgical failures, that at least 80 per cent to 85 per cent are cured by simple gastro-enterostomy. The main difference is whereas Doctor Moschcowitz is proud of the 80 per cent to 85 per cent cures, it appears to him that Doctor Lewisohn is proud of his 50 per cent failures.

DR EUGENE H. POOL thought Doctor Lewisohn had defined very clearly the advantages of anacidity, but did not think he has proved that these advantages compensate for the increased dangers of resection in cases of duodenal ulcer. His arguments are not altogether convincing for the reason that his figures are so much at variance with the figures which have been gathered in every other place where a study has been made of the cures and failures of gastro-enterostomy especially the percentage of marginal ulcers after gastro-enterostomy. This summer the speaker was very much enlightened during a trip to European clinics in seeing the overwhelming tendency toward sub-total gastrectomy for gastric and duodenal ulcers. This is based upon a feeling of the importance of removing the pyloric portion of the stomach to bring about anacidity. In Alessandri's Clinic in Rome he saw the results of experimental studies on the occurrence of marginal ulcers. They reported that in dogs where gastro-enterostomy was performed and the pylorus divided, ulcers developed in a large proportion of cases, but that following gastro-enterostomy and resection of pyloric end of stomach, in no case had marginal ulcer occurred. This, of course, is an argument for gastrectomy, but these ulcers occurred very soon after operation and were not comparable to the chronic indurated ulcers we see in man.

In general the operations upon the stomach were very well done in the European Clinics. There was in von Haiberer's Clinic only 4 per cent mortality with resection. Gosset was one of the few who did not favor partial gastrectomy for duodenal ulcer, but preferred gastro-enterostomy. He voiced the sentiment of most of the American surgeons who were present. He stated that gastro-enterostomy would be the procedure he would elect if he had a duodenal ulcer and said, "What is good enough for me is good enough for my patients."

DR HOWARD JULIENTHAL said that in 1914 he presented before the International Surgical Society, at its session in New York, a report on 12 cases, in which he had performed operation for duodenal and pyloric ulcer. There was resection of the pylorus with a considerable part of the stomach in two stages preceding the resection by gastro-enterostomy. He has never had occasion to change his mind as to the proper course in cases of this kind.

He emphasized the point that after gastro-enterostomy a secondary stomach resection can be done with less danger than in a single stage. Therefore, why make a final program until one knows what the less dangerous procedure will accomplish?

DR JOHN DOUGLAS said that even if Doctor Lewisohn has proved the failure of gastro-enterostomy to reduce the acidity of the stomach contents it must be remembered that this is only a part of his general blanket indictment of gastro-enterostomy as a whole. He starts with the subject of the results of drainage after gastro-enterostomy by citing experiments with methylene blue and other dyes, and concludes that nearly all the dye went through the pylorus and little through the stoma, which was therefore not effective. In the last edition of Cairman's book, as a result of examinations in the Mayo Clinic, he states that after gastro-enterostomy radiographic examination with an opaque meal, showed that a large proportion of the food rapidly passes through the stoma. In a series of 12 to 14 cases X-rayed after gastro-enterostomy, done at St. Luke's Hospital, the emptying time of the stomach was shorter than it was in a normal stomach. If this is so, one purpose of the operation was accomplished. As to the question of anacidity as a desirable thing, Doctor Lewisohn makes a strong case in stating that jejunal ulcer never occurs in an anacid stomach. But ulcers do occur with low acidity and we have patients with high acidity who never have ulcers. There must, therefore, be another etiological factor beside the acidity. When Doctor Peck read his paper last year the speaker looked up the St. Luke's Hospital records and found that 85 or more per cent of gastric or duodenal cases were symptom free and a considerable number beyond that of patients who only after indiscretions of diet would have symptoms. As far as the sleeve resection is concerned, Doctor Lewisohn stated that it was followed by anacidity on the basis of three cases. The speaker mentioned one case which continued to have a high anacidity after sleeve resection. While he felt that Doctor Lewisohn had made a case for subtotal resection in gastric ulcer, the speaker considered that it was still questionable whether it is justifiable to do so large an operation for duodenal ulcer when such a large percentage of cures by means of gastro-enterostomy are still being reported from American statistics.

DR ALLAN O. WHIPPLE said that in seeing so much radical gastric surgery of the stomach during the past summer on the travel trip mentioned by Doctor Pool, it was a very natural desire on their part to find out what the real results were in these cases of subtotal gastrectomy for duodenal ulcer. They tried to find out what they meant by after-results and discovered that they had no such thing as a real follow-up system. He could get no information of how many cases had been followed. This is a very significant matter, because so much of the influence of the foreign clinics has been brought to bear on the question of the necessity of doing these more radical operations, and a number of American surgeons are doing this radical surgery, for no other reason apparently than that it is being done by well-known

surgeons abroad The validity of this radical surgery can be decided only by an honest and complete follow-up of these patients over a period of three to ten years

DR JOHN F CONNORS remarked that Doctor Lewisohn said the operation should be governed by three points, the third of which is that it should establish a permanent anacidity in order to prevent the recurrence of an ulcer Was one to infer from this that in removing the acid-forming area (the pylorus) one had removed the main etiological factor in the formation of ulcer? If this be true, it is a great advance in the treatment of these cases, and would point the way to a much more intelligent mode of procedure

DOCTOR LEWISOHN, in closing the discussion, said that a strong case against gastro-enterostomy had been made The mortality following simple gastro-enterostomy at the Presbyterian Hospital was stated to be over 10 per cent Doctor Lewisohn said that he had performed a partial or subtotal gastrectomy for gastric or duodenal ulcers either by the Billroth I or retrocolic Billroth II method in 33 patients, with one death (mortality 3 per cent)

The two-stage operation, as suggested by Doctor Lilienthal, was a very good procedure in certain well-selected cases

The anacidity following sleeve resection suggested further experimental studies which might throw light on the importance of the reentrant angle as a factor in post-operative anacidity

BOOK REVIEWS

TUMORS OF THE SPINAL CORD AND THE SYMPTOMS OF IRRITATION AND COMPRESSION OF THE SPINAL CORD AND NERVE ROOTS, PATHOLOGY, SYMPTOMATOLOGY, DIAGNOSIS, AND TREATMENT By CHARLES A. ELSBERG, M.D., Professor of Neurological Surgery, Columbia University, 8vo, 421 pp Paul B. Hoeber, Inc., New York, 1925

DEAR DOCTOR PILCHER

It is said that the critic is bound by no rules but that he is free to express himself in almost any way that his mood suggests. I am taking this privilege and putting this criticism in the form of a letter, because this book brings up memories of our associations covering now more than forty years. In the early years when I was associated with you as a young man for the *ANNALS*, when it still carried editorial articles which gave careful summaries of important literary contributions to the science and art of surgery and when it had a department devoted to résumés of important articles in current medical literature, I had the honor of working with you along those lines. You will remember also that for a number of years Pilcher and Lloyd wrote the articles on the Surgery of the Brain, Spinal Cord and Nerves for Sajous' Annual, while I burnt the midnight oil and you passed the manuscript. This association was so delightful and the memories have remained so vivid that I cannot avoid referring to them as I have finished the review of this valuable contribution to the surgery of the spine which Doctor Elsberg has given us.

Few men have had the opportunity of handling, collating and studying 100 consecutive cases of spinal surgery. The book, then, is one that comes from a master in the art, and deserves more than a passing comment. As one reads page by page, one is struck by the valuable suggestions that constantly come out, even in description of the individual cases. As the author says in his preface "The subject of spinal cord tumors and the symptoms that result from the slowly increasing pressure upon the spinal nerve roots and upon the cord itself, present many features that are of importance not only to the neurologist, but also to the medical practitioner, the orthopedic and the genito-urinary specialists and the surgeon. To recognize that a pain in the chest is not due to intra-thoracic disease but to a spinal cord irritation, to distinguish between symptoms due to intra-abdominal disease and root symptoms due to spinal disease, to understand the true significance of a brachial, intercostal, or sciatic neuralgia may be difficult and may tax the diagnostic acumen of the physician. The same statement applies to the differentiation of symptoms of primary disease of the bladder or prostate gland from the rectal and vesical disturbances that occur in spinal disease. Not so rarely patients have been treated for long periods and subjected to operative interference for supposed intra-abdominal or pelvic disease when the cause was in the spinal cord or nerve roots.

Doctor Elsberg throughout the book has evidently had this idea in mind, and we constantly find the emphasis on those symptoms that make differential diagnoses much easier than they formerly were. One cannot but congratulate the author upon the clearness with which he has expressed himself and the care that he has taken to emphasize these questions. How well this is illustrated by the following paragraph: "The compression of the veins of the neck is also a procedure of value during an operation for spinal cord tumor if the growth has not been found in the area of the cord that has been exposed. This procedure, which was suggested by Dr. Jason Mixer, of Boston, permits one to learn during the operation whether the growth is above or below the part of the spinal cord that has been laid bare. If the tumor is above the level exposed, then compression on the veins of the neck will not be followed by a flow of cerebrospinal fluid from higher up, if, on the other hand, the tumor is at a lower level, compression of the jugular veins will cause a free flow of cerebrospinal downward from above." How often in the old days have we gone down upon a supposed carefully located tumor of the spine only to find that it was not in the exposed area, and then have attempted by means of a probe passed up and down to determine whether the tumor was above or below, only to find ourselves blocked by the insufficiency of the data which such a procedure gave?

One has not time nor space to give this book the careful analysis it deserves. We notice that in the operation the author follows the original Abbe technic, in which he cuts down on both sides and frees the spinous processes, and removes them completely by the use of the rongeur forceps. We cannot help but think that the modification of this operation suggested by the writer of this criticism is still an improvement on that technic. In this method, only one side of the spinous processes was denuded, and then by the use of the Liston bayonet forceps, rather than the rongeur, the spinous processes were cut free at their base and left attached to the flap of the other side. This obviates the necessity of cutting through the inter-spinous ligaments. It is true, it may require a somewhat longer incision and the separation of one or two more spinous processes than in the operation where they are completely removed, but, on the other hand, it has the advantage that it retains the inter-spinous ligaments intact, saves the spinous processes which become fixed in the new growth covering the gaps made by the removal of the laminae, and has other distinct advantages.

His warning about any pressure upon the spinal cord itself in the course of the operative procedure is most timely. Recently we have seen one or two operators who have pushed the cord to one side digitally, necessarily bruising it more or less and with a resulting increase in paraplegia.

The illustrations are well done, and the book has been presented in an especially attractive shape. We not only have to congratulate the author and the publisher, but to thank them for giving us this resume of such an abundant surgical experience.

SAMUEL LLOYD

BOOK REVIEWS

THE CIRCULATORY DISTURBANCES OF THE EXTREMITIES, including Gangrene, Vasomotor and Trophic Disorders By LEO BUERGER, M A, M D, New York City 8vo, 628 pages Philadelphia and London W B Saunders Company, 1924 Cloth

In this book, the author has brought together the results of his investigations on the circulatory disturbances of the extremities during the past eighteen years. During this whole period he has written voluminously and well, especially on the subject of thrombo-angietis obliterans. The profession as a whole has welcomed this work and has tried to keep pace with the investigations but, spread through the literature as it was, it was difficult to follow and required time and labor to hunt out the different articles. This book, embracing as it does the results of his experience and research, is a welcome contribution to our surgical armamentarium.

In his introduction the author outlines his purpose to lay before the reader first, the anatomy and histology of the normal vascular apparatus of the extremities, second, the anatomy and physiology of the nervous mechanism that controls the vessels, third, a consideration of normal and pathological local circulation, fourth, a comprehension of the origin and action of thrombosis, the mechanical and the thermal agencies on the tissues, fifth, the subject of gangrene in relation to clinical, diagnostic, and pathological aspects, and, sixth, an exposition of the clinical course of all those diseases, whether of organic, vascular, neuro-vascular, or vasomotor causation, that have given and still do give the physician much difficulty in clinical differentiation.

In spite of this very extensive field which the author has laid out for himself, the work is admirably done. His chapters on anatomy are well presented, and the illustrations from Sobotta are clear and distinct. One notices in the chapters on *thrombo-angietis obliterans* that the author omits the possible etiological factor which has been suggested by several authors, that is the poisoning with carbon monoxide.

We have not seen a work that presented these questions so well as in the present book, and we cannot but congratulate the author on the way he has brought together the views of the different investigators. He has not hesitated to present both sides of any unsolved problem, and the references to the authorities who urge the different theories are carefully given. We must, however, criticize the unusual use of words, as, for instance, the poetic form of often and the use of motivate in place of induce or cause, and other instances of the bizarre use of the English language. However much one may use these in ordinary writing, it is distinctly out of place in a scientific treatise.

SAMUEL LLOYD

FACIAL SURGERY By H P PICKERILL, C B E M D M S, Surgeon in charge of Facial and Jaw Department Dunedin Hospital With an Introduction by Sir Arbuthnot Lane New York William Wood and Co, Edinburgh, E S Livingstone 8vo, 162 pp. 1924

This is an interesting book covering the principles of the operations upon the face, giving a good résumé of the war surgery, and an especially good

account of the principles methods and technic of plastic surgery. While there are a good many very original operations outlined still it is interesting to note how, even in a large individual experience, all technic falls back on the principles of facial surgery which have been in vogue for so many years. It is rather interesting to compare the operations in this brochure with those published so many years ago by Szymanowsky, and to note the evolution of the different operations through the years that have passed. The use of the pedicle graft in many of these cases is evidence of a great deal of manual dexterity.

The work is admirably illustrated and is a very valuable contribution to plastic surgery.

SAMUEL LLOYD

DIE OERTLICHE BETÄUBUNG, ihre wissenschaftlichen Grundlagen und praktische Anwendung. By PROF. DR. HEINRICH BRAUN, Leipzig. Barth 1925.

Braun's original work on local anæsthesia had been so well planned and illustrated in the previous editions of his book that few changes could be expected in this seventh German edition (1925). The sixth edition (1921) has had the good fortune of an English translation last year and the profession has already familiarized itself with the many interesting features it contains.

The first part of the book is remarkably instructive. It is devoted to the history of local anæsthesia and deals with local anæsthetic agents and the various methods of using local anæsthetic drugs. Infiltration and conduction anæsthesia are given the attention which they deserve. Mention is made of Tutocain as a new local anæsthetic drug. It is only in this last feature that the first part of the seventh edition differs from that of the sixth.

The chapter "Operations on the Neck" has been rewritten, the cervical plexus block being replaced by another procedure which is said to be associated with no untoward effects. Injection of the upper poles of the thyroid gland is recommended from two points taken on the surface of the skin. The superficial landmarks are not very accurate and the injection is rather delicate.

The chapter "Abdominal Operations" has been revised and enlarged. Descriptions are given of the technic of splanchnic analgesia by the posterior route (Kappis) and anterior route (Braun), the latter being recommended as the procedure of choice.

There has been practically no change along the lines of spinal and sacral anæsthesia which are described under the single heading, "Lumbar and Sacral (Epidural) Anæsthesia."

Spinal (lumbar) anæsthesia occupies a very narrow space and is "restricted in general to operations in regions supplied by nerves from the lower segments of the spinal cord, such as the perineum, sacral region (urethra, prostate, rectum) and legs." The old theory of the diffusion of

the drug to the higher regions of the spine is still alluded to when recommendation is made not to elevate the pelvis. Braun uses novocain-suprarenin tablets dissolved in physiological salt solution. It is to be regretted that he made no attempt to discuss the fall of the blood-pressure and completely ignored the Trendelenburg position during spinal anaesthesia.

Of the methods of blocking the sacral nerves, Caudal or Epidural anaesthesia is described, as well as "Parasacral" which is Braun's method of injecting the sacral nerves on the anterior aspect of the sacrum. No description is given of the transsacral method which, in recent years, has become so popular in many European countries and in America, especially in surgery of the bladder, prostate, urethra and rectum.

Failure to include methods which have been given due recognition in other parts of the world is highly indicative of the expression of personal experience on which the entire work is based. Although depriving the reader of descriptions and discussions of some of the latest achievements in local (regional) anaesthesia, Braun's book remains what it was originally a masterpiece.

GASTON LAPAT

SKULL FRACTURES. By WILLIAM H. STEWART, M.D., Rontgenologist to the Lenox Hill and Harlem Hospitals. Cloth, pp. 64, plates 44, 1925. Paul B. Hoeber, New York.

This is the sixth volume of a series of monograph atlases, edited by Dr. James T. Case, under the title of *Annals of Rontgenology*. Those on the mastoid, gall-bladder, digestive disturbances in infants and children, normal bones and joints and on the teeth and jaws have preceded it.

It is of the utmost value to have for reference an atlas of the various types of fracture of the skull, presenting skiagraphs which reproduce examples so perfectly and with which class of cases the author has had such an extended experience. Of particular interest is the depiction of those occurring in the base of the skull for which a satisfactory technic has been evolved which is described in detail in chapter two. The normal rontgenological pictures of the frontal, lateral and basilar regions are particularly informative and of especial value when used for comparison in cases where injury has occurred.

The increasing frequency of occurrence of fractures of the skull, due especially to automobile accidents makes the present volume more than academically valuable, as the medico-legal aspects of accidents involving injury to the head become so important. Interesting observations are given in chapter five in the consideration of the time factor of the disappearance of rontgenographic evidence in fractured skulls. Apparently ossified union in these flat bones is a comparatively slow process and may vary from six months to five years, the distance of separation of the fragments apparently being the determining factor.

Errors into which the observer is likely to fall are carefully considered.

and the points in differentiation between fracture and the appearance of unusual venous markings or shadows of grooves on the inner table to accommodate the meningeal arteries which are in many instances confusing are noted and well illustrated

There is no other work on this subject comparable, in scope of consideration and detail and profusion of illustration, to this volume. It must prove of the utmost value not only to the roentgenologist, but to the surgeon and general practitioner and particularly as an authority to be referred to in court proceedings.

In an introductory chapter, Dr. William H. Lockett has made some surgical comments, concluding that all other methods of diagnosing fractures of the skull should, in his opinion, be made subservient to that of the X-ray. His remarks deal chiefly with the relative incidence of fracture of the skull *in comparison with fracture of other bones of the body*, placing it fourth or fifth on the list (about 7 per cent), but does not consider the question of surgical intervention in these cases as one might have anticipated.

JAMES T. PILCHER

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CANCER OF THE HEART*

SECONDARY TO CANCER OF THE BREAST BY DIRECT LYMPHATIC EXTENSION

BY ROBERT KAPSINOW, M D

OF NEW HAVEN, CONN

CARCINOMA of the heart, secondary to that of the breast, is so uncommon a condition, that it is of great interest to report the following case. A diligent search of the literature has failed to reveal any case of this nature.

REPORT OF CASE

Mrs E H (St Agnes, No 34,988) was admitted to the Surgical Service of Dr Joseph C Bloodgood, in St Agnes' Hospital, of Baltimore, Md, September 24, 1924.

She first noticed a lump in her left breast about May, 1922, but neglected to have medical attention for six months. At that time she was advised to have the breast removed but put it off for another six months. On July 6, 1923, she had a radical breast operation performed by Doctor Swope, of Pittsburgh.

In May, 1924, the patient began to have shortness of breath which was frequently associated with agonizing pains in the precordium radiating to the base of the neck and to the back. These pains were becoming so frequent, that she required large doses of morphia.

Shortly after the onset of the pain, she noticed small B B shot growths about the scar of the old operation. On examination, she showed a scar of the previous operation about which were found numerous B B shot skin metastases. These were found chiefly about the lower end of the scar. The axilla was free of any involvement.

Vocal fremitus was increased throughout both sides but the resonance was impaired only at the left side of the precordium. Breath sounds were harsh. There did not seem to be any evidence of fluid in the chest. The heart sounds were very faint. No murmurs could be heard.

The abdomen was distended and tender. The liver edge was palpable three finger-breadths below the costal margin. No fluid present in abdomen.

X-ray examination by Dr Max Kahn revealed a cloudy shadow to the left of the heart extending up to the fifth rib which was interpreted as fluid.

Laboratory findings. Red blood-cells, 4,424,000. white blood-cells 11,000. hemo-



FIG 1.—Cross-section of base of heart showing involvement of aorta and pulmonary vessels in cancer mass.

* From the Surgical Clinic of St Agnes' Hospital of Baltimore, Md.

globin, 70 per cent, polymorphonuclears, 68 per cent, large mononuclears, 3 per cent, small mononuclears, 27 per cent, transitionals, 20 per cent. Urine—trace of albumin.

The condition of the patient became progressively worse. The attacks of pain were typical of angina pectoris usually due to coronary occlusion. She died during one of these attacks on October 4, 1924, ten days after admission.

Autopsy Findings—The skin and subcutaneous tissue of the left chest was found to be studded with cancerous nodules, extending downward to the interspaces of the ribs.

On lifting the chest wall, it was found that the carcinomatous tissue had invaded the anterior mediastinum. The lymph-nodes behind the azygoid were enlarged to the size of a hen's egg, protruding into the left pleural cavity. These masses were yellowish-white in color and cut like cartilage. The entire pericardial sac was thickened and

leathery in feeling and showed gross cancer. At no point was the pericardium adherent to the heart.

At the base of the heart, the cancerous invasion was enormous. The tumor tissue was found compressing the pulmonary and aortic vessels for a distance of 2 inches (Fig 1). It extended downwards, replacing all the muscular tissue of the auricles and even into the ventricles. The endocardium and valves were grossly normal in appearance. The right coronary was completely imbedded in firm cancerous tissue so that a probe could only be inserted into the vessel with difficulty (Fig 2).

Neither lung showed



FIG 2.—Longitudinal section of heart. Auricles consist chiefly of solid cancer tissue. Coronary artery can be seen imbedded in the mass.

any malignant invasion. There was a small amount of bloody fluid present in the left pleural cavity.

On the superior surface of the liver, numerous white areas measuring 2 to 15 mm in diameter were found. There was no deep invasion. The gall-bladder and common duct were studded with cancer nodules. The head of the pancreas and the omentum likewise contained cancer nests. The other viscera were essentially normal.

Histological Findings—Sections taken from the pericardial sac demonstrates typical scirrhus cancer. The superior mediastinal lymph-nodes are entirely filled with rapidly growing malignant cells (Fig 3). Specimens taken from the auricles demonstrate strands of cancer tissue permeating between the muscle fibres (Fig 4).

The involvement of the liver suggests that here the invasion is from the peritoneal surface inward producing a cone-shaped nest. These nests are produced by retrograde lymphatic invasion. The subperitoneal lymphatics of the gall-bladder and common duct are filled with rapidly growing cancer cells. In the pancreas, the strands of invading tissue seem to follow the course of the blood-vessels.

Description of Lymphatic Channels Involved—The afferent lymphatic vessels of the breast empty into the axillary lymph-nodes of both sides, retro-

CANCER OF THE HEART

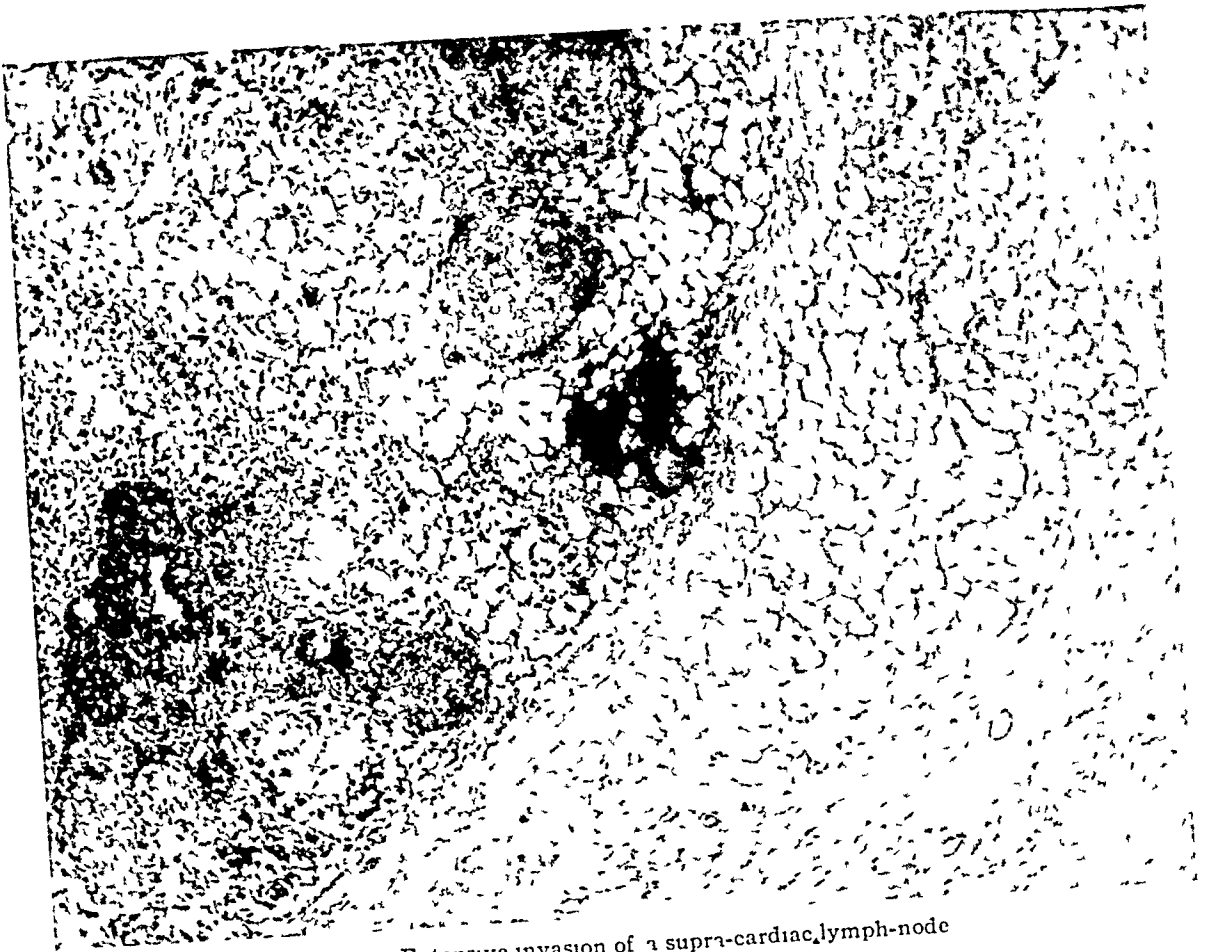


FIG 3 — Extensive invasion of a supra-cardiac lymph-node



FIG 4 — Muscle fibres of the auricle penetrating a cancerous mass

pectoral, retrosternal, supraclavicular and paramammary nodes. This may be called the primary circulation. This system is correlated with a secondary distribution consisting of lymph vessels draining into the deep cervical, diaphragmatic, hepatic, supraxiphoid, intercostal and inguinal nodes.

From a statistical study of secondary invasion from the primary source, it seems that the hepatic division is the most important of the secondary circulation. The importance of any individual group of secondary nodes depends upon the extent of the primary invasion. This is difficult to determine at the time of the operation. For this reason one cannot foretell where the metastatic growth might occur.

In this particular case, it seems as though the original growth extended towards the retrosternal lymph-nodes of the primary circulation by following the perforating branches of the internal mammary artery. These trunks are subject to early senile atrophy and hence accounts for the infrequency of retrosternal involvement.

From the retrosternal nodes, the tumor extended through the lymphatics of the anterior mediastinum to the base of the heart and downwards through the hepatic channels to the liver, gall-bladder and pancreas. The invasion of the heart must have preceded the abdominal growths by several months, judging from the size alone.

It is unusual that there should be no pulmonary metastases with such extensive invasion of the heart and pericardium.

SUMMARY

An unusual case of carcinoma of the heart, secondary to that of the breast, is reported. The distribution indicates that the growth was a retrograde invasion by direct continuity along the lymphatic channels described.

I wish to express my appreciation to Dr. Joseph C. Bloodgood for his kind assistance in the study of this case.

THE DEVELOPMENT OF CARCINOMA IN SCAR TISSUE FOLLOWING BURNS*

BY FREDERICK M. JOHNSON, M.B., TOR

OF ATLANTA, GA

THE formation of carcinoma in scar tissue constitutes a rare, but nevertheless a well recognized clinical entity. As early as 1828 Marjolin¹ emphasized the importance of the condition and for many years in the French medical literature such tumors were associated with his name.

Cutaneous cicatricial tissue resulting from any form of injury may, under certain circumstances, become the seat of malignant transformation. Thus epithelioma develops in the scar in a considerable proportion of cases of lupus vulgaris, and less frequently with lupus erythematoses (Ashihara²). Da Costa³ has stated that fully 18 per cent of lupus cases develop carcinoma after X-ray treatment. This should not be interpreted, however, as indicating that radiation is responsible, because epithelioma is by no means uncommon following other methods of therapy. It would appear therefore that the cicatrix itself is suitable soil for malignant growth.

The scar of an ordinary injury is not immune. Just⁴ has reported in reference to a man, age thirty-nine, who developed squamous-cell carcinoma in the scar of a wound produced by a rock-cutting instrument. The injury required three months to heal, and four years later, following an abrasion, cancer appeared, which metastasized very rapidly with a fatal result. Volkmann's⁵ patient received a lacerated wound of the calf of the leg when a young man. After an interval of thirty-five years the scar ulcerated, became malignant and grew with marked momentum.

Other varieties of injury, such as dog-bite, or freezing (Eckermann⁶), have preceded scar carcinoma. Dupuytlen⁷ has pointed out the possibility of cancerous change in cicatrices during the decline of life and described two instances in which malignant disease supervened on the scar of an amputation stump. Ruchaud⁸ has observed cancer on many varieties of scars such as old osteomyelitic foci and perineal fistulae, but it is on burned areas that this accident occurs most frequently. Durand's⁹ thesis is illustrative, in 90 cases of degenerated scars 70 were caused by old burns. Baasner¹⁰ was able to collect 33 instances from the German literature prior to 1900.

In the space of a year four cases of ulceration occurring in the cicatrix of extensive burns have been observed at the Steiner Clinic of Atlanta, Ga. Of these three were proven microscopically to be squamous-cell carcinoma while the fourth was benign in character but clinically precancerous.

CASE I—M. J. a female age thirty-two was severely burned when three years old. Healing was not complete until four years had passed. Twenty-three years later, an ulcer appeared in the scar overlying the right hip. As it slowly grew pain became

* From the Radium Department of the Steiner Clinic.

severe, and for this an operation was performed by an army surgeon in Honolulu after which skin grafting was attempted, but with no success

The woman was healthy except for a huge deep neoplastic ulcer measuring 20 x 30 cms in diameter, overlying the right great trochanter. Surrounding the ulcer was a pale, smooth, glistening, fixed scar which extended upwards and inwards to fill the groin. There were no enlarged lymph-nodes.

Treatment consisted of cautery excision of the tumor and adjacent scar followed by skin grafting. During the next two months there were three small recurrences, all being superficial and easily removable. The wound has been healed and free of palpable tumor for a period of eleven months.

CASE II—E D, a female, age forty-five, fell head first into an open fire when four months old. The wounds were unhealed for eight years. Ten years previous to admission to the clinic an ulcer appeared back of the forehead.

When admitted the face was hideously deformed. The anterior half of the scalp was devoid of hair and replaced by a shiny, firm cicatrix. Overlying the right parietal bone was a thick, laminated, adherent crust covering a superficial ulcer 3 x 2 cm in size. There were no enlarged cervical lymph-nodes. The clinical diagnosis was acanthoma, which was confirmed microscopically by the study of a minute piece of the ulcer edge.

Treatment—Surgical excision was advised, but this the patient steadfastly refused. Finally the ulcer was treated by means of silver filtered, radium emanation tubes, held in place by dental modelling compound with the result that a neoplastic ulcer has been converted into an indolent benign ulcer.

CASE III—J E, a female, age sixty-nine, was badly burned on the right forearm at the age of eight. The wound never completely healed and for sixty-one years she had worn an arm dressing. Three years ago the ulcer commenced to discharge profusely and to give off a bad odor. For six months there had been rapid decrease in weight, the pain had been severe and several weakening hemorrhages had occurred.

The patient when admitted was in a semi-conscious state. The temperature ranged from 97 to 103° F, and the pulse from 120 to 140 beats per minute. The red blood-cell count was 1,840,000, white blood-cell count 15,250 and hæmoglobin 30 per cent. The right elbow and wrist were fixed in partial flexion by stout bands of scar tissue. On the front of the forearm, beginning at the wrist and extending upwards halfway to the elbow, was a bulky, excavating ulcer with depressed necrotic base, and with raised, typically neoplastic edges. The ulcer margins practically became confluent on the dorsal surface. There were no enlarged axillary nodes.

Treatment—To relieve the patient of a foul, painful, septic focus, amputation at the mid-portion of the upper arm was performed rapidly, using novocaine anaesthesia. The wound healed well, and in a few days the general condition was better, the mind was clearer and the blood picture more normal. There has been no return of the tumor during a period of a year.

CASE IV—D W, a female, age thirty-eight, was burned on the right thigh and abdomen thirty-one years previously. Two years were required for complete healing. During the last six years, an area in the scar of the loin had ulcerated and healed several times.

The scar of the flank presented an ulcer 10 x 15 cm in diameter. It was very superficial, and had smooth edges and a glazed indolent base. It lacked the characteristic vigorous overgrowth of cancer. No enlarged nodes were felt.

Treatment—Cautery excision and skin grafting were performed. The microscopical report on the tissue removed was benign ulceration with no precancerous tendency. The new scar has remained healthy for about eight months.

Etiology—Epithelioma of the skin is induced almost exclusively by the chronic injury of previously normal or abnormal tissue. It is not difficult to

CARCINOMA IN SCAR TISSUE

understand how a defect in the regeneration of burned skin would if subjected to irritation, provide a suitable medium for unrestrained cell growth. Hulke¹¹ has written that malignant disease occurs on scars of slow formation and that pliable cicatricial tissue is not dangerous. This at once indicates the desirability of skin grafting as a measure to be adopted early in the treatment of burns. The lesions that I have seen are in strict accord with Hulke's observation. In the third case repair was never complete and incredible as it may seem, the patient was content to wear a dressing for sixty-one years.

Sex—Although the cases reported here are all females, scar cancer, like skin cancer in general, occurs more frequently in men because of the greater likelihood of inciting factors.

Age—Scar carcinoma is not restricted to the old or middle aged. The ages of the patients in this series are 32, 45 and 69. It would seem, therefore, since the burn in each case occurred in early childhood that the age of the scar and not of the subject is the more important.

Location of Ulcer—Those parts of the body most liable to exposure will be most likely to undergo scar change. According to Ruchaud⁸ these are in order, arm, leg, head and trunk. He further noted, that the upper arm is affected more often than the forearm and the thigh more often than the leg.

Symptomatology—The development of scar cancer is insidious. Ruchaud⁸ who had an unusual opportunity for studying the early manifestations, described the various origins as follows:

(a) A small, indolent and itchy papule is often the beginning at first firm and resistant, later becoming moist and ulcerated.

(b) Occasionally a true keloid forms and the cicatrix is lifted entirely. This tumefaction is painful and ulcerated at its centre, and the hardened edges turn outwards, forming thereby a typical canceroid.

(c) In a very great number of cases the scar loses its integrity before becoming epitheliomatous. Ulceration is provoked frequently by the patient who scratches at a cicatrix which in the course of time has become pruritic. The surface is covered later with squamous plaques which, when rubbed off, are replaced by small sanguinous ulcerations. Fissures are formed which fuse, and the true ulceration is constituted. The physician thinks, then, of a simple irritative lesion, but the hyperæsthesia and tumefaction even at this period serve to give the diagnosis.

(d) Accidental opening of a scar is frequent, and the tissue repairs itself only very slowly, if not hindered by constitutional disease nor local dyscrasia. The patient disregards the scar, and the wound gradually increases at the expense of the neighboring parts.

Type of Cancer—I am unable to find in the available literature any reference to basal-cell carcinoma appearing on scars of burns. The squamous-cell variety is invariable and the flat indurated infiltrating type is more frequent than the papillary of which only a few examples are described (Marjolin,¹ Scagholi¹²).

Progress of the Disease—When well established the rate of growth is

slow, slower in fact, than with cancer of healthy skin (Verdelet¹³) This may be accounted for by the anæmic state of the usual thick scar Most writers are agreed, however, that once there is deep invasion of the underlying muscle tissue, conditions are reversed, and an abundant blood supply nourishes the malignant cells for the production of a growth which quickly destroys (Boegehold,¹⁴ Mollière¹⁵) Mohr's¹⁶ patient, following amputation of an arm, rapidly weakened and died from pulmonary hemorrhage Autopsy revealed extensive metastatic deposits in lungs, pleura heart and kidney Durand⁹ reported a case of carcinoma developing in the cicatrix of a burn in the region of the knee which produced metastases to iliac, pelvic and lumbar lymph-nodes and a tumor in the liver as large as an orange Such extensive generalization is unusual in squamous-cell cancer of any situation, and it shows very strikingly that under proper conditions of growth, scar carcinoma is capable of very active behavior Heidingsfeld¹⁷ observed a tendency to spontaneous repair, but it is doubtful if the scar degeneration in this instance had reached the malignant state From a consideration of these and other references it would appear, that although a few observers have been inclined to consider cancer arising on scars of burns a relatively benign lesion practically all hold the opinion that the disease may and does follow a very malignant course, and while it is less formidable at the beginning, the cells take on a more embryonic type as it advances

Treatment—This naturally resolves itself into prophylactic and curative

Prophylactic—Proper surgical care at the time of the burn will do much towards the prevention of thick, rigid delayed scars Modern hospital facilities, and the general adoption of skin grafting has improved the character of cicatricial tissue to such an extent that this type of malignant disease will be encountered much less frequently as time goes on Once a disfiguring and band-like scar has formed, there remains always, the potential danger in later years This can be minimized by the protection of the scar against all forms of injury such as friction of clothing, irritation by dirt and insects, prolonged suppuration, and accidental wounds

Curative—Curative treatment is strictly surgical In the reported cases which have been reviewed, no mention was made of the use of physical agents except by Heidingsfeld¹⁷ who used X-ray in a very advanced case, without apparent success Since the curative value of radium and X-ray depends in a large measure on local tissue reaction and adequate blood supply, the use of these agents in the treatment of a tumor with a scar tissue foundation would be unwarranted In the second case of this series an indolent benign ulceration is the undesirable result of radium treatment Surgical excision, still is being constantly advised, and still as constantly rejected by the patient

The management of metastatic nodes when accessible is likewise a surgical problem which must be faced aggressively The region should be subjected to Röntgen-ray exposures both before and after excision The use of

unfiltered emanation tubes in the wound at the time of operation is of definite value

I agree whole-heartedly with de Nanciede¹⁸ when he says that although cancerous change in scars of burns is taught in books and lectures very few believe in its actual occurrence. A knowledge of the potential danger that rests in old cicatricial tissue at once points the way to prompt removal of the first break in continuity, whether it be benign or malignant in character.

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TUBERCULOSIS OF THE BREAST*

AS OBSERVED AT BELLEVUE HOSPITAL OF NEW YORK CITY

BY J WILLIAM HINTON, M D

OF NEW YORK, N Y

ADJUNCT ASSISTANT VISITING SURGEON, BELLEVUE HOSPITAL

AND

THEODORE C LAWSON, M D

OF BERKELEY, CAL

HOUSE SURGEON ON THE FOURTH SURGICAL DIVISION OF BELLEVUE HOSPITAL

To THE literature on this subject which has been thoroughly reviewed in the past few years by Elkins,¹ Leavitt,² and Cahill,³ we wish to add a case which has come under our observation on the Fourth Surgical Division of

TABLE I

Abstract of Cases of Tuberculosis of the Heart Treated at Bellevue Hospital of New York City

Case	Date	Age	Sex	F H	P H	Present nursing children	Duration	Trauma	Pain	Tenderness
No 1 A B "14506"	7/24/11	30	F	Neg	Neg	O	3 mos	O	X	X
No 2 M M "741"	1/27/13	23	F	Neg	Neg	O	6 mos	O	X	O
No 3 M H "5430"	8/15/16	20	F	Neg	Neg	O	3 mos	X	X	X
No 4 M A "8027"	12/16/16	54	F	Neg	Neg	O	8 mos	O	X	X
No 5 M G "773"	2/ 3/19	25	F	Neg	T B Adenitis	O	4 yrs	O	O	O
No 6 L L "5317"	7/27/19	35	F	F died T B	Abscess right neck	O	1 yr	O	X	X
No 7 E Mc "1283"	5/13/22	26	F	Neg	Neg	O	2 yrs	O	O	X
No 8 M W "627"	3/30/25	65	F	Neg	Chr dry cough 8 yrs	O	2 mos	O	O	O

* We are indebted to Dr Carl G Burdick, Director of the Fourth Surgical Division, for the privilege of reporting this case, and Dr Douglas Symmers, Director of Laboratories for the privilege of using the pathological material of this series Also Drs R S Hooker, Harold E Santee and George D Stewart, Directors of the First, Second and Third Divisions, respectively, for the privilege of reviewing the cases on their divisions

TUBERCULOSIS OF THE BREAST

TABLE II

Case	Side	Quadrant	Size	Sinuses	Skin	Retraction of nipple	Glands	Other notes
No 1 A B "14506"	L	Middle below nipple	Whole breast	O	O	O	O	Lungs clear
No 2 M M "741"	R	Middle upper half	Goose egg	O	O	O	O	Lungs clear
No 3 M H "5430"	R	LLQ	Walnut	O	O	X	Cervical old	Old cervical glands Lungs clear
No 4 M A "8027"	R	RUQ	3×4 cm	O	O	O	O	Lungs clear
No 5 M G "773"	L	LUQ	LUQ of breast	X In L axilla	X Retraction	O	Cervical and axillary	Râles in L apex of lung
No 6 L L "5317"	L	LUQ	Diameter 1½ inches	O	O	O	O	Old healed abscess on rt neck
No 7 E Mc "1283"	R	LLQ	4×3 cm	O	O	O	Enlarged rt axillary gland	Lungs neg
No 8 M W "627"	R	RUQ	Diameter 3 cm	O	O	X	X Along axillary border	Dullness and X-ray of lungs

TABLE III

Case	Wassermann	Pre-op diag	Path diag	Treatment	Result (discharge)
No 1 A B "14506"	Neg	Abscess of breast	T B and suppurative mastitis	Incision and drainage Biopsy	Cured
No 2 M M "741"	None	T B of breast	T B of breast	(1) Biopsy (2) Simple mastectomy	Improved
No 3 M H "5430"	Neg	T B (abscess) of breast	Chronic mastitis milary tubercles	Simple mastectomy	Improved
No 4 M A "8027"	Neg	Ca of breast	Tuberculosis of breast	Radical mastectomy	Cured
No 5 M G "773"	None	T B of axilla and chronic mastitis	T B of lymph-nodes, probable T B of breast	Radical mastectomy	Cured
No 6 L L "5317"	None	Ca of breast	Adenocarcinoma of breast and T B	Radical mastectomy	Cured
No 7 E Mc "1283"	Neg	Ca of breast	Intracanalicular adenofibroma and T B lymph-nodes breast	Radical mastectomy	Cured
No 8 M W "627"	Neg	Ca of breast	T B of breast	Radical mastectomy	Cured

Bellevue Hospital and also review the cases which have occurred on all of the divisions since 1911. The symptomatology and physical findings in this series have not agreed with some of the previous reports, and we present the tabulated findings in the eight cases which have occurred in the hospital during this period of time. (See Tables I, II and III.) Tuberculosis of the breast is spoken of as being primary and secondary. In our case it was presumably secondary to a chest condition which was not diagnosed either clinically or by the roentgenological department, but in reviewing the plates after the pathological report had been received, the findings would point to tuberculosis.

The X-ray of the chest wall April 7, 1925, No. 117756, showed "Moder-

ate degree of dilatation of the aortic arch. No enlargement of heart to left. Marked enlargement of the lymph-nodes at the right root. Two small localized areas of infiltration in the basal portion of the right upper lobe, suggesting metastatic lesions."

In this series the average age was 34.7 years, the oldest 65 and the youngest 20 years. All were in females and none of them were nursing at the time the enlargement was first noticed. The duration of the history



FIG. 1 —Shows gross appearance of mass in the breast tissue after it was sectioned

averaged one year and five months, the longest being four years and the shortest two months.

The pre-operative diagnosis was made in three of the eight cases. The chief point of interest in the history of this condition is pain which was present in five of the eight patients. Cahill² states that pain is a late symptom, but this was not true in this series. On physical examination five of the eight patients complained of tenderness over the enlargement which is not usually encountered in cases of malignancy. Some authors state that the upper and outer quadrant is more frequently involved. This series showed practically no difference in the relation of the quadrants that were affected. The axillary lymph-glands were found enlarged in three cases. There seemed to be

no difference in the sides involved, as the right was affected in five and the left in three. The nipple was retracted in two and the skin was retracted in one case. We did not find the typical "pig skin" appearance over the tumor which is frequently described. A Wassermann was done on five of the eight patients, and in all of these it was negative. A history of trauma was obtained in one case. Physical examination of the chest revealed rales in two of this series. Evidence of a previous cervical adenitis was found in two cases. The family history of tuberculosis was negative except in one case. One gave a history of having had a dry cough for approximately eight years, without expectoration.

CASE HISTORY—

M. W., sixty-five years, widow. Two months before admission to Bellevue Hospital, while bathing, noticed a lump in her right axilla at the anterior axillary border, size of a cherry, non-tender, movable, not adherent to skin. This gradually grew in size to 4 x 3 cm. Three weeks later, or five weeks ago, noticed a similar lump in right upper quadrant of the right breast not adherent to skin, freely movable, discrete, non-tender, about size of cherry, gradually growing in size to 2½ to 3 cm in diameter. No other lumps felt. One week ago noticed beginning retraction of right nipple. No discharge. Loss of weight 55 pounds in last year. Appetite poor for past two months. No nausea vomiting etc. Personal history negative for tuberculous carcinoma diabetes or serious illnesses. Usual childhood diseases. Has a chronic dry cough. Slight dyspnea on exertion noticed during winter months for past eight years. No expectoration. Hemoptysis pain night sweats etc.

Family history negative for tuberculosis cancer diabetes nervous or chronic diseases. Three children. All grandchildren well.

Physical examination. General elderly and fairly well developed and well fed.



FIG. 2.—Microphotograph showing "giant" cells and lymphoid infiltration.

woman of about sixty-five not appearing acutely ill walking about showing no evidence of marked or sudden loss of weight

Chest Expansion fair, equal on both sides and symmetrical

Lungs T F normal Dulness at right apex over sternum and right sternal border and distant breathing No bronchial breathing No râles or pleural friction rub Left breast negative Right breast normal in size, nipple retracted, no discharge About 4 cm to right and above nipple is a small non-tender mass, discrete, freely movable, moderately indurated, not attached to skin, about 3 cm in diameter Along the anterior axillary border in the lower right axilla is a similar mass, 3x4 cm, showing same characteristics as above mass No œdema or pig skin appearance No other mass or nodes felt in breast, axilla or supra- and infraclavicular regions

Pre-operative diagnosis Adenocarcinoma of right breast with metastasis to axillary lymph-glands

Operation Usual axillary pectoral extirpation

Gross pathology On sectioning the mass of the axillary lymph-gland and the tumor of the breast thin pus was evacuated The microscopic picture revealed tuberculosis of the axillary gland and breast tissue Figure 1 shows the gross appearance of the mass in the breast after it was sectioned Figure 3 is a microphotograph under low power, showing giant cells and lymphoid infiltration

Pathological diagnosis Tuberculosis of breast and axillary lymph-gland

Patient made an uneventful recovery Wound healed by primary union and patient was discharged from the hospital on the twelfth day

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TUBERCULOSIS OF THE MAMMARY GLAND*

BY ARTHUR M. SHIPLEY, M.D.

AND

HUGH R. SPENCER, M.D.

OF BALTIMORE, MD.

THE frequency or rarity of a particular infection in a tissue depends, to a considerable extent, upon the ability of that tissue to provide the essentials necessary for the growth or destruction of a particular organism. Thus it is that tuberculous processes in the lungs and lymph-nodes are of frequent occurrence, while in such tissues as voluntary muscle, myocardium and mammary gland, this type of infection is an unusual condition.

With reference to the mammary gland, a review of the literature serves to emphasize the infrequency of tuberculosis of that tissue. Anspach,¹ in 1904, reviewed the literature up to that time and compiled a series of 77 cases. Deaver,² in a review of the literature from 1904 to 1914, compiled a series of 74 cases, including 5 from his own service. Elkin³ in a review of the literature from 1914 to 1922, compiled a series of 29 cases, including 7 of his own, 3 of which had been previously reported by Cheever.¹⁰ Elkin's series included cases reported by Miles,⁴ Gatewood,⁵ Durante and MacCarthy,⁶ and Hamilton.⁷ Since 1922, a number of new cases have been added to the literature, notably by Leavitt,¹¹ who reported 2 cases, Engel,¹⁵ who reported 1 case, Archibald,¹⁶ who reported 1 case in a Sudanese, Chauvin,¹⁷ who reviewed the literature and reported 3 additional cases, Raw,¹⁸ who, in a study of 10,000 cases of tuberculosis seen in hospitals and in private practice, observed 7 cases of tuberculosis of the mammary gland and Cahill,¹² who reported a case of tuberculosis in the mammary gland of a colored female aged thirteen years.

The incidence of tuberculosis of the mammary gland in comparison to all other lesions of that organ is brought out by the following figures:

In Deaver's² Clinic, tuberculosis made up less than 1 per cent of all breast cases, or 2.5 per cent of all benign breast lesions. Durante and MacCarthy,⁶ in a series of 1933 mammary conditions, reported an incidence of 0.51 per cent of mammary tuberculosis. Gatewood⁵ reported 1.04 per cent of all breast lesions seen at the Presbyterian Hospital, Chicago, 1906-1916, as tuberculous. Bloodgood⁹ reported 6 per cent of all benign breast lesions in his service as tuberculous. Scott⁸ reported 1.31 per cent of tuberculosis in a series of 1830 breast cases. Cheever,¹⁰ in a series of 228 breast lesions, reported an incidence of 1.7 per cent of tuberculosis. F. B. Mallory, in discussing the paper of Leavitt¹¹ reported that in the pathologic examination of 2297 breasts, 14 of them, including the 2 reported by Leavitt, were tuberculous, an incidence of 0.6 per cent.

* From the Departments of Surgery and Pathology of the University of Maryland, School of Medicine.

Of the 180 cases collected by Anspach,¹ Deaver² and Elkin,³ 120 presented no clinical evidence of tuberculosis elsewhere and were regarded as primary cases. In the cases collected by Deaver,² more than 70 per cent occurred between the ages of twenty and fifty years. The literature in general indicates that the period of most frequent occurrence is between those ages.

As brought out by Durante and MacCarthy⁴ a number of terms have been employed to describe the various aspects of tuberculosis of the mammary gland.

In general, however, three main types may be distinguished, *i.e.*, the nodular or discrete and the confluent types as originally described by Dubar¹³ and the sclerosing type as described by Scott.⁹ In any type the lesion or lesions are practically always unilateral and are often confined to one quadrant (upper and outer—Halstead and Lecount)¹⁴. In from 60 to 75 per cent of all cases, the axillary lymph-nodes on the corresponding side are involved (Gatewood⁵).

In the nodular or discrete form, one or many firm discrete nodules may be felt, while in the confluent type, through the coalescence of smaller areas, larger and more or less irregular masses can be palpated. It is in these types that a more or less acute process is often noted, with redness of the skin over the area, fluctuation, eventually sinus formation and even superficial skin ulceration. Sections of these lesions present a picture somewhat resembling a chronic mastitis, with a grayish discoloration of the glandular and adipose tissue. In many instances, yellowish caseous areas with surrounding grayish zones are seen. Often pressure expresses a whitish-yellow necrotic debris from the dilated ducts. Sinuses filled with necrotic material may be present.

In the sclerosing type, analogous to the more chronic and fibrotic forms of tuberculosis elsewhere, the lesion is firm and irregular, and the breast is apt to be distorted. On section a diffuse fibrous mass with relatively little caseation is seen. Such fibrous areas may or may not be in relation to deeper-seated "abscess" masses. This type is more common in older women and is not infrequently mistaken for malignancy.

Retraction of the nipple and pigskin appearance may be seen in any of the forms. Clinically, the diagnosis is based upon the chronicity of the lesion, together with a tendency to infiltration and softening. The skin may ulcerate relatively early, and sinuses leading from the scrofuloderma to the underlying tuberculous area are often seen. When the lymph-nodes in the axilla and along the pectoral muscles are involved, they are usually not so hard as in malignancy.

The histological picture is usually adequate for a definite diagnosis. Bacteriologically, the organisms are found with difficulty. In the more obscure cases, positive information may be obtained through guinea-pig inoculation.

The following 10 cases of mammary tuberculosis have been observed in a series of 671 breast cases at the University Hospital, an incidence of 1.49 per cent for all breast lesions studied.

TUBERCULOSIS OF THE MAMMARY GLAND

CASE I—Chart No 9659-A Surgical Pathology No 431 Colored female, thirty-eight years old Admitted October 31, 1905 She gave birth to one child at the age of sixteen years Previous history unimportant

The present illness began about one year ago, with a small lump in the right side of neck The mass was not tender, but was painful on pressure Later on, a lump appeared on either side of the neck, and two masses were noticed in the left breast She had a cough with some expectoration, with occasional night sweats, but no loss of weight

The physical examination showed many enlarged cervical glands with small sinuses leading from a number of them There were several scars and keloids on the right side of the neck The glands in the axillæ were enlarged and there were a number of sinuses There were two lumps in the left breast, more or less independent of one another The whole breast appeared more or less diffusely involved

The pre-operative diagnosis was tuberculosis of the cervical and axillary lymph-nodes and of the left breast

The entire breast and all the axillary nodes were removed

Pathology Diffuse tuberculous involvement of the confluent type with typical tubercles in the breast and axillary lymph-nodes

CASE II—Chart 9722-A Surgical Pathology No 463 White female, forty-two years old Admitted December 21, 1905 Patient had five children There was a history of a fall ten years before admission, at which time she struck the left breast on the corner of a step It was painful for several days and later a small lump appeared in the left breast, which broke down with a serous discharge It was treated with apparent cure Six months before admission, the left breast became extremely painful and began to discharge from the site of previous injury

The physical examination at the time of admission to the hospital showed no evidence of tuberculosis of the lungs The left nipple was retracted, and there was an area of superficial ulceration 1 cm in diameter at a point 5 cm above the nipple There was marked, though localized induration in the breast tissue beneath this area The axillary lymph-nodes were not definitely enlarged

The pre-operative diagnosis was carcinoma of the left breast The left breast and axillary nodes were removed

Pathology Diffuse fibrosis, with dilated and cystic ducts and many typical tubercles Caseation was not marked

CASE III—Chart No 10844-A Surgical Pathology No 548 White female, forty years old Admitted June 3, 1906 Had nine children There is a history of one sister who was tuberculous, and the eldest son was a cripple

Five months before admission, the patient noticed a lump in the right breast about the size of a marble, 2.5 cm above the nipple The mass was firm, but not sensitive, it had increased in size and surrounded the nipple In the past two months, the lump had increased steadily in size, it became softer and was painful and tender By gentle massage, the patient could express a greenish-yellow, foul-smelling discharge from the nipple She was never able to nurse her children comfortably from the right breast after nursing her first child, and as a result used a breast pump

The physical examination showed the patient to be of slight build and only fairly well nourished There was no evidence of tuberculosis of the lungs There was a mass about the right nipple, and the axillary nodes were enlarged

The pre-operative diagnosis was carcinoma of the right breast

Radical breast amputation was done

Pathology Confluent tuberculosis of breast with caseation and typical tubercles The axillary lymph-nodes also showed tuberculosis

CASE IV—Chart No 13042-A Surgical Pathology No 704 White female, forty-four years old Admitted April 17, 1907

The present illness began five weeks previous to admission, with the appearance of a lump in the upper and outer quadrant of the left breast. The pain radiated down the

left arm The lump in the breast gradually increased in size Previous to the appearance of the lump, there was poor appetite, some loss of weight with sallow skin and pale mucous membranes The heart and lungs appeared normal There was a small lump in the left breast near the nipple, which was freely movable, but the nipple was not involved, and the axillary glands could not be felt

The pre-operative diagnosis was carcinoma of the left breast

Radical breast amputation was done

Pathology Caseation, typical tubercles, moderate fibrosis

CASE V—Chart No 1344 Surgical Pathology No 3769 White female, sixty years old There was no history of this patient, except of a preëxisting tuberculous involvement of the right axillary lymph-nodes

The pre-operative diagnosis was tuberculosis of the right breast and axillary nodes

Resection of the breast and axillary nodes was done

Pathology Sclerotic tuberculosis of the breast, tuberculosis of the axillary glands

CASE VI—Chart No 4131 Surgical Pathology No 4308 White female sixty-one years old Admitted November 28, 1916 with a non-painful lump in the right breast of two weeks' duration Seven months before admission a number of tuberculous nodes were removed from the right axilla

The physical examination showed a lump in the right breast, 2.5 cm in diameter, firm, not attached to the skin and not tender There was no retraction of the nipple Otherwise the examination was negative

The pre-operative diagnosis was tuberculosis of the right breast

Resection of the breast was done

Pathology Many small cellular and caseous tubercles

CASE VII—Chart No 7862 Surgical Pathology No 5153 White female, twenty-five years old Admitted September 3, 1917

For the past year, the patient has had enlarged and swollen glands in the right axilla These glands later broke down, drained and closed time after time The right breast became swollen and tender

The patient was well developed and well nourished The lungs seemed clear of tuberculosis There were several small sinuses in the right axilla, discharging a creamy muco-purulent material The surrounding tissue was inflamed and indurated The nodes were enlarged, fairly firm, and fixed to the skin and underlying tissue The right breast was swollen and tender, and the skin was reddened No definite nodules were felt in the breast

The pre-operative diagnosis was tuberculosis of the right breast

The breast and axillary nodes were removed

Pathology Confluent involvement, cellular and caseous tubercles

CASE VIII—Surgical Pathology No 10104 White female, forty-two years old

The patient was the mother of three children, and for some time before admission, noticed some superficial ulceration of the nipple Her youngest child was eight years old There was no discharge from the nipple

When examined, there was some retraction of the nipple with superficial ulceration, and under the nipple in the centre of the breast, there was an area of induration The margins of the indurated mass were indefinite, and there was a number of small firm lymph-nodes in the axilla

The pre-operative diagnosis was carcinoma of the breast with Paget's disease of the nipple

Radical breast amputation was done

Pathology Diffuse fibrosis with numerous tubercles, little caseation

CASE IX—Chart No 43246 Surgical Pathology No 13288 White female, thirty years old Admitted May 6, 1925

The patient has one child aged six years

Family history and past history were negative

TUBERCULOSIS OF THE MAMMARY GLAND

The present illness began two weeks before admission with a painful lump in the left breast, and for two days the nipple has been retracted

The physical examination was negative except for the breast. The central portion of the left breast was occupied by an indistinct mass, not very hard but quite tender, which was attached to the deeper structures. There was some retraction of the nipple, but no discharge. There was a fever of 100, and the patient complained considerably of pain and tenderness in the breast. No enlarged glands could be felt.

The pre-operative diagnosis was chronic inflammation.

Resection of the mass was done.

Frozen section at time of operation eliminated malignancy.

Pathology. Mass in central portion of breast, worm-like casts of ducts extruded when mass is squeezed.

Microscopic. Many cellular and caseous tubercles. Many giant cells, confluent process.

CASE X—Chart No. 43265. Surgical Pathology No. 13292. White female, fifty-nine years old. Admitted May 7, 1925.

The patient was told five years ago that she had tuberculosis, but with the exception of a slight non-productive cough, she has been well up to the present illness, which began one year ago, when she noticed a small mass in the lower portion of the right breast. This had gradually increased in size. Three months ago the skin over the mass became ulcerated. She has lost about ten pounds in weight and now has a productive cough and occasional night sweats.

There was found on examination a movable tumor in the outer hemisphere of the right breast in the anterior axillary line about the size of a small orange, hard, indurated, fixed to the underlying structures, with superficial skin ulceration and a foul discharge. The axillary nodes were large. There were many fine râles heard in the right lung. X-ray examination showed pleural involvement and apparently metastatic nodules in the right lung.

The pre-operative diagnosis was ulcerating carcinoma of the right breast with metastases to lymph-nodes, pleura and lung.

Radical breast amputation was done.

Pathology. Marked diffuse fibrosis with moderate caseation, many giant cells.

SUMMARY

In the ten cases here reported, all have been in females. The average age was forty-four years—youngest twenty-five years—oldest sixty-one years. In one case there was a family history of tuberculosis. In one case there was a history of trauma. In five cases there was clinical evidence of preexisting tuberculosis elsewhere. There was an involvement of the cervical lymph-nodes in one case and of the axillary nodes in six cases. In all cases the lesion was unilateral, with involvement of the right mammary gland in seven cases, and of the left in three cases. The lesions were single in five cases, multiple in two cases, and diffuse in three cases. The portion of breast involved was very irregular. There was skin ulceration in three cases, retraction of the nipple in two cases, discharge from nipple in one case, and sinus formation in one case.

The pre-operative diagnosis was tuberculosis in four cases, chronic mastitis in one case and carcinoma in five cases.

There were no deaths in the series, and consequently no opportunity for post-mortem examination.

COMMENT

Tuberculosis of the mammary gland is of interest not only from the standpoint of its rarity but also because of uncertainty as to the mode of infection and from the point of differential diagnosis. More than 60 per cent of the cases reported have been classified as primary ones, these have for the most part, been women who were otherwise in good health and in whom no clinical evidence of tuberculosis could be found.

It is recognized, of course, that tubercle bacilli from some preëxisting focus may reach the mammary gland through the blood stream and through the lymphatics, or by direct extension, with resultant secondary infection but it is difficult to understand how except by direct inoculation through cuts, abrasions or through the lactiferous ducts at the nipple, breast tissue should be primarily involved any more than should tissues such as bone. Unfortunately, as Gatewood⁵ has noted, in no reported case has there been a complete study of the body at autopsy, so that the question of the existence of a primary lesion in the mammary gland cannot be settled.

Halstead and Lecount,¹⁴ Bundschuh²¹ and Gatewood⁵ were of the opinion that the majority of cases of mammary tuberculosis were the result of retrograde lymphatic involvement from the axilla or from some intra-thoracic focus. This belief was based upon observation that in a number of instances the involvement of the axillary nodes seemed definitely to precede the mammary involvement, and this opinion is strengthened through the recognition of the intimate relationship of the mammary gland to the axillary and mediastinal lymph-nodes.

In our own series, three cases at least seemed the result of retrograde infection from the axillary nodes, one case apparently represented a retrograde infection from the cervical nodes, and one was secondary to tuberculosis of the lungs and pleura.

In a number of instances, Deaver,² Leavitt,¹¹ and others,^{10, 20} and as shown in our own series, tuberculosis of the mammary gland is confused with carcinoma of that tissue, this is particularly true of the sclerotic type.

In five of our cases, the pre-operative diagnosis was carcinoma, but in two of these instances the character of the lesion at operation was such as to exclude malignancy, so that a less radical procedure was adopted.

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DIAGNOSIS AND TREATMENT OF FRACTURES OF THE SKULL AS DEVELOPED IN THE CINCINNATI GENERAL HOSPITAL

By B N CARTER, M D
OF CINCINNATI, OHIO

FROM THE DEPARTMENT OF SURGERY OF THE UNIVERSITY OF CINCINNATI MEDICAL COLLEGE AND THE CINCINNATI GENERAL HOSPITAL

IN THE present report it is aimed to bring out as far as possible the relation between various clinical aspects and therapeutics of skull fractures. With these ideas in mind we present a study of 223 cases which represent the cases admitted to the Cincinnati General Hospital in 1922 and 1923, all of which with few exceptions have been personally observed and treated.

The procedure followed in this Clinic is to observe the patient for varying periods of time before any operative interference is offered, unless he presents a compound fracture, a depressed fracture, or signs and symptoms of an extradural hemorrhage, in which event he is operated on immediately provided his condition permits it. During this observation period various studies are made which form the basis for his subsequent management. These consist of a general physical and neurological examination, a record of pulse and respiration every twenty minutes, frequent temperature observations, an X-ray of the skull, and a spinal puncture with a record of the spinal fluid pressure.

To our minds the most important phase of the treatment is this observation period when one recognizes and interprets correctly the changing train of signs and symptoms and on them bases his subsequent procedures. Under observation patients fall into the following groups *ie*, (1) those whose injuries are incompatible with life and who rapidly die, (2) those who show only mild degrees of injury and who never present alarming symptoms, and (3) those who stand between groups (1) and (2), whose outcome is problematical and whose management is both difficult and fascinating. An analysis of our cases shows the following:

Age—Between 1 and 10 years of age, 41 cases—mortality 14.6 per cent
Between 11 and 20 years of age, 29 cases—mortality 13.7 per cent
Between 21 and 30 years of age, 31 cases—mortality 32 per cent
Between 31 and 40 years of age, 36 cases—mortality 38.9 per cent
Between 41 and 50 years of age, 29 cases—mortality 58.6 per cent
Between 51 and 60 years of age, 25 cases—mortality 44 per cent
Between 61 and 70 years of age, 21 cases—mortality 42.8 per cent
Between 71 and 80 years of age, 6 cases—mortality 66 per cent

These figures corroborate those of other observers as to the more favorable prognosis in children as compared with adults. This is due to several factors such as the greater elasticity of the bones, the lack of fusion of the suture lines, and the lack of adherence of the dura to the skull. It is less

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often necessary to resort to decompressions in children, and one finds fewer cases with depressed fractures. It is interesting to note that the greater number of cases occurring in any one decade is found in the first. It is to be expected that after the age of 50 the mortality is increasingly high.

Sex and Race—There were in the series 183 males (mortality 35.5 per cent) and 40 females (mortality 36.1 per cent). One hundred and eighty-six (mortality 38.2 per cent) were in the white race and 37 (mortality 33.4 per cent) in the colored. There is little of significance in the sex or race as such, since the severity of the injury is the most potent factor.

Type of Fracture—Here one finds a marked variation in the mortality and there is much of prognostic value in the type of fracture. The most innocuous fractures are the simple fractures of the vault, whereas, the most serious are those involving the base.

Number of simple fractures of the vault, 59—mortality 13.5 per cent

Number of simple fractures of the base, 33—mortality 42.4 per cent

Number of simple or depressed fractures of the vault and base 107—mortality 47.6 per cent

Number of compound fractures of the vault, 8—mortality 12.5 per cent

Number of compound, comminuted depressed fractures, 16—mortality 37.5 per cent

Mixter,² in 1917, reported 301 cases of fractures of the base of the skull with a total mortality of 54.1 per cent (but of only 36.5 per cent in that part of the series from 1911-17). He, however, eliminated the cases with severe associated injuries and those which died within two hours, whereas, our series includes all cases. Ransohoff,³ in 1910 reporting on 190 cases of fracture of the base of the skull, shows a mortality of 65 per cent, and quotes Cushing as having a mortality of 80 per cent before he began to do decompressions. Phelps⁴ reports 570 cases of fracture of the base with a mortality of 54.5 per cent, and 213 cases of fracture of the vault with 28.6 per cent. Candon and Wilson⁵ show 530 cases of fracture of the base with 41 per cent mortality. The compound fractures of the vault do extremely well with immediate operation. They rarely show marked signs of pressure as they tend to decompress themselves through their wounds before operation. The compound, comminuted depressed fractures with extensive cortical laceration and associated basilar injuries are of most grave prognosis. The simple depressed fractures of the vault offer a good prognosis and are best treated by immediate elevation of the fragments.

Mode of Injury—One hundred and eleven of the 233 cases were caused by automobiles, i.e. about one-half of all our cases, and of the 80 cases in the series that died 52 per cent were due to the automobile. This emphasizes first the importance of the automobile as a factor in producing skull fractures and, secondly, the seriousness of the injuries thus sustained. The injuries caused by the automobile are usually very extensive ones and are so often associated with fractures of other bones "stove-in" chests or intra-abdominal injuries. One particularly fatal form of injury as noted by us are those cases which receive a very forcible blow on the point of the jaw with a

fracture of the jaw and a fracture from indirect violence to the base of the skull. Of these we have had 6 cases, all of which died within a few hours.

State of Consciousness—Much stress was laid on the state of consciousness as of value in prognosis and as a guide in treatment by early writers such as Hippocrates, Pare, Quesnay, Potts and Abernethy. Of our 223 patients 47 were fully conscious on admission, and of these 3 died—a mortality of 6.4 per cent. Sixty-six were semi-conscious, of whom 5 died—a mortality of 7.5 per cent. As against these two classes of cases was that in which the patients were unconscious on admission and remained so for a varying period of time, of whom there were 107 with a mortality of 66.3 per cent. In 3 cases no mention was made of the state of consciousness. Phelps⁶ reports that of 542 cases of fracture of the skull with unconsciousness 318 died, of 76 practically conscious 30 died, of 289 who were conscious 80 died. In Ransohoff's³ cases of fracture of the base 95 per cent showed some change in the state of consciousness, and of 98 cases in deep coma 70 per cent died. The state of consciousness influences us greatly in the treatment. If consciousness is retained at the same level we are inclined to wait longer before decompressing (even if the pulse is slow but regular and respirations are quite slow but not varying in depth) than we would be in an unconscious patient with the same degree of slowing of the pulse and respiration. A steadily increasing state of consciousness we feel to be a good omen, even if some of the other findings are not so encouraging, whereas, a deepening state of unconsciousness causes us considerable alarm and demands urgently relief of pressure. The classical picture of an immediate loss of consciousness, followed by a clear interval, which is in turn followed by a second loss of consciousness, calls for an immediate operation which nearly always discloses an extradural hemorrhage. To recapitulate, a persistent deep coma means serious intracranial damage and grave prognosis (66 per cent mortality in our cases), retention of consciousness is quite favorable, a returning consciousness even in the presence of unfavorable symptoms is most encouraging, but a deepening coma is indicative that the case is progressing unfavorably and measures for relief of pressure should be instituted.

Temperature—Of the 223 patients, 82 had a normal or plus normal temperature on admission, and in this group there was a 26.6 per cent mortality. One hundred and thirty-eight patients had a subnormal temperature on admission, with a mortality of 45 per cent. Patients presenting a subnormal temperature on admission are those with the most severe injuries and associated shock for which reasons the mortality is especially high. In the individual case the temperature on admission means little, unless it is extremely high or unduly low, in either event offering a poor prognosis. On the other hand, the course that the temperature takes later on does have a definite meaning. Cases with a steadily mounting temperature reaching 104°–106° rarely recover, for this is associated so often with deep coma, Cheyne-Stokes respiration, cyanosis and weak, rapid pulse, and with them

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means that the stage of cerebral decompensation has been reached. In cases in which the temperature remains subnormal the danger from shock is of paramount importance. In favorable cases the temperature rises promptly after shock is recovered from, but does not usually go higher than 102° , it then falls by recessions of a degree or so a day. The onset of meningitis is usually indicated by a sudden rise of several degrees. Brain abscess is usually associated with normal or subnormal temperature. We do not believe a decompression advisable in a patient whose temperature is 102° and steadily mounting. Wilensky⁷ has called attention to the prevalence of fever in skull fractures and attempts to explain it in one of three ways: (1) The upset of the heat centre, (2) meningitis, or (3) the escape of cerebrospinal fluid through tears in the pia which in the presence of a bacteraemia gives a temporary mild meningitis. Courtney⁸ states that the temperature stands supreme in scale of importance among the valuable prognostic and diagnostic signs. He feels that contusions of the brain are associated with a temperature around 102° and if the case is progressing favorably it falls gradually, but if unfavorably, it mounts steadily, lacerations of the brain give an immediate upward trend with infrequent and slight recessions. Nichols⁹ states that the temperature is low in simple oedema but high with lacerations of the brain. Phelps⁶ feels that with a primary temperature of 102° , or a subsequent one of 105° , there are no recoveries.

The Pulse—Much information of value may be derived from the pulse. On admission the pulse has significance only if it is very slow, 30–40, or very fast, 120–160. Rates between these convey little of immediate prognostic or diagnostic value. It is what happens to the pulse later that is of significance. Our records show 84 cases admitted with a pulse of 90 or over, with a mortality of 39 per cent, 85 cases with a pulse of 70–90, with a mortality of 31 per cent, and 54 with a pulse of 70 or below with a mortality of 37 per cent. A steadily diminishing pulse-rate means a steadily increasing intracranial pressure and indicates that the pressure must immediately be relieved. In addition to the actual slowing of the pulse, one notes a slight irregularity in rate first—thus, if one holds the pulse a full minute or two, he will count it 50 for one-quarter and perhaps 90 the next. When this is noted we feel that unless urgent steps are taken for the relief of pressure, the case will soon pass over into that stage where therapy will be of no avail. When a pulse that is steadily rising goes over 120 we feel that operative interference is not indicated. On the other hand, a slowly increasing pulse-rate that does not go over 90 or 100 is a good omen. One too often sees a pulse going from 50 per minute to 140 in a very short space of time, and if this occurs the prognosis is absolutely bad. The most important features of the pulse in skull fractures are (1) that a steadily slowing rate or the same slow rate associated with a slight irregularity, calls for relief of pressure, (2) a weak rapid pulse is of poor prognosis and contra-indicates operation. No definite lower limit to the pulse-rate can be set when operation is indicated but one must consider the other aspects of the case in

conjunction with the pulse. A case with a consistent pulse of 50 or below usually comes to operation. A comparison of both radial pulses was not done regularly, so we are not prepared to comment on the difference in the pulses on the two sides as noted by Phelps⁴ and which he ascribes to an interference with the correlation of the sympathetic and central nervous systems.

Blood-pressure—Unfortunately, our observations on this phenomenon are not accurate or sufficient enough to justify any report. From the literature it would seem that the blood-pressure changes are not consistent enough to be of much value as a sign on which prognosis may be based.

Respiration—Number of cases with respiration over 12, 192 with 33 per cent mortality. Number of cases with respiration 12 or less, 16, with 43 per cent mortality. Number of cases with respiration Cheyne-Stokes, 59, with 80 per cent mortality.

(NOTE: Deaths overlap in these cases *etc.*, one death may be counted under two headings.)

If when one first sees a case it presents Cheyne-Stokes respiration, the prognosis is usually bad, or if this type of respiration is allowed to appear in the course of the disease the hope of recovery is slight. We are particularly careful to pay the closest attention to the respiration and feel that (1) a steadily slowing respiration means increasing pressure, (2) frank Cheyne-Stokes respiration combined with rapid, weak pulse and coma, contra-indicate operation, (3) slight early irregularity in depth of respiration is most important as a positive sign of impending decompensation. It is necessary to watch the respirations for several minutes with a good view of the chest and abdomen in order to appreciate the first appearance of irregularity. We have noted in several cases a peculiar sigh interspersed at intervals in otherwise regular respiration and have come to regard this as a particularly ill omen.

Bleeding—Number of patients bleeding from nose or mouth, 59 mortality 44 per cent. Number of patients bleeding from ear, 84, mortality 50 per cent. Number of patients not bleeding, 80, mortality 12.5 per cent.

Phelps⁴ states that of 285 of his cases that bled from the ear, 119 died, and of 90 that bled from nose or mouth, 51 died. Crandon and Wilson⁵ report 395 cases with bleeding from ear, nose or mouth with 181 deaths, they advise against irrigation of ears or nose. Ransohoff³ emphasizes the seriousness of bleeding from the nose as in 19 of such cases only 4 recovered. Bleeding from the ears, nose or mouth mean usually more extensive injury to the base of the skull and a resultingly high mortality. At this point we would like to emphasize the importance of caring properly for a bleeding ear or nose. Negligence in this precaution is sure to lead to a certain number of cases of meningitis. Cleanliness and avoidance of introducing fluid into the ear or nose are the essentials. We are in the habit of cleansing the external ear or nares with gauze moistened in hydrogen peroxide (not irritating), and applying a large sterile dressing to the ear. This is changed as often as necessary. Under this regime we have had only 2 cases of meningitis which

is a bit lower than one finds in other series published. Thus, Mixer² reports 8 cases in a series of 301, Wilensky¹⁰ 4 in 75, LeCount¹¹ 39 in 504, Phelps⁴ 20 cases in 1000, Ransohoff¹ 4 in 190. We have seen brain substances in the external auditory canal in 3 cases two of which promptly died and one recovered without operation, but was mentally deficient when last heard from. Phelps⁴ reports 3 similar cases with the same result.

Examination of the Fundus—This we have not found to be particularly useful as an aid in diagnosis, except in the later stages of the disease when one suspects pachymeningitis hemorrhagica or other causes of long-continued pressure. In the acute stages the fundi rarely, in our experience, give any information other than what one can glean from other sources. Kearney¹² reports constant findings of blurring of disc edges with some oedema, Wilensky¹⁰ agrees with this, but other observers fail to corroborate, thus, Cohen¹³ in 75 cases never saw a choked disc or doubts if it occurs, though he finds frequently a fulness of the vessels and slight blurring of the disc edges, Jackson¹⁴ does not feel that the fundi show much change early and does not rely on them.

Pupils—Cases with pupil dilated on the side of the lesion, 48, mortality, 52 per cent. Cases with pupil dilated on the opposite side of the lesion, 20, mortality, 95 per cent. Cases with no pupillary change, 155, mortality, 23 per cent.

The pupillary changes we feel are rather good indications of the amount of intracranial damage. An extreme amount is associated often with fixed dilated pupils and here the mortality is extremely high, in our series 100 per cent. This seems universally true, thus Cohen¹³ calls attention to the poor prognosis associated with fixed dilated pupils, Nichols⁹ advises against operation when they are present, Crandon and Wilson⁷ show 131 deaths in 142 cases, Ransohoff¹ 42 cases with 41 deaths. The dilated pupil is most often on the side of the injury, for there the damage is severe, so much so, as to cause 52 per cent mortality in our series, when, however, the pupil on the opposite side is dilated, we are inclined to feel that the contre-coup damage is more severe than that on the side of the injury and that the sum total of the injury is such that an extremely poor prognosis is offered. When a pupil which was large on admission comes down to normal size, the prognosis is apt to be favorable, but when a pupil which was equal to its mate on admission later becomes dilated, we feel that the intracranial damage is progressing and becomes suspicious of an extra or intradural hemorrhage. Walton¹⁵ feels that the pupillary changes are due to injury to the cilio-spinal tract. Phelps¹⁶ states that a single dilated pupil was found in 11 out of 30 cases of extradural hemorrhage, both pupils were dilated in 7 cases normal in 3, and contracted in 5, and quotes Hutchinson as saying that a single dilated pupil meant an extradural hemorrhage in the middle fossa on the same side. Crandon and Wilson⁷ show that in 155 cases with unequal pupils 90 died, Holman¹⁷ emphasizes the value of unilateral dilatation as a localizing sign and cautions as to its transitory character.

Convulsions—Cases presenting focal convulsions, 7 Cases presenting general convulsions, 2 Mortality 66 per cent

Convulsive seizures ordinarily mean extensive cortical damage rather than extradural hemorrhage, for in the latter case one more frequently finds paralysis than an irritation. When a focal convulsion is repeated two or three times over an interval of an hour or so we are in the habit of operating as much for the possibility of correcting damage which may later lead to epilepsy as for immediate results. We do not believe that one focal attack, particularly in children, calls for operative interference, as we have two cases which recovered spontaneously.

Paralysis—In our opinion a definite, persistent, paralysis or weakness of an extremity in a patient with a skull fracture is an absolute indication for operation. A hæmiplegia, if one can rule out an apoplectic stroke and coincident skull fracture, is an urgent indication for operation, for it is so frequently associated with extradural hemorrhage. Facial paralysis is most often due to injury to the nerve in the canal and scarcely falls in the same category as paralysis of an extremity. In our series 25 patients presented evidence of paralysis with a mortality of 48 per cent. We have not encountered a case of longitudinal sinus syndrome as described by Holmes and Sargent.

Reflexes—Not many cases in this series show changes in the reflexes. About all one learns of value as to the reflexes is that absent reflexes are of very grave prognosis, and that any real change in the reflexes means more damage within the cranium and therefore a more serious prognosis than if the reflexes were unchanged. Our records show normal reflexes in 183 cases with a mortality of 28.4 per cent, absent in 17 with 100 per cent mortality, increased on the side of the lesion in 10 with 50 per cent mortality, and increased on the side opposite the lesion in 13 with a mortality of 46 per cent. The impression gained from the literature is that changes in reflexes are apt to be transitory and are of little value both in prognosis and as an indication for operative interference.

Spinal Puncture—Reports as to the use of lumbar puncture in the treatment of fractures of the skull begin to appear in the literature about 1905. From that time until about 1922 most of its advocates were among the French and Italians. Jackson,¹⁴ in 1922, strongly advocated its use and seems to have stimulated interest in it as a diagnostic and therapeutic agent. Until four years ago we had been fearful of performing spinal puncture on patients with skull fractures on account of the supposed danger of medullary paralysis. We have been using it as a routine measure in the series of cases herewith presented and now feel that not only is it not dangerous, but is frequently of real value either therapeutically or from a diagnostic viewpoint. One hundred and seventy-eight of our patients had one or more lumbar punctures, and of this number only one showed ill effects attributable to the puncture. This occurred in a patient who later was found to have a large extradural hemorrhage. The ill effects manifested were a focal convulsion becoming generalized, weak, rapid pulse, irregular respiration and coma. He rallied, however,

and was later operated on. More will be said later of the use of lumbar puncture in extradural hemorrhage. In doing a puncture one should proceed cautiously, allowing the fluid to escape very slowly and having the patient quiet before making a reading of the pressure. Our readings are made with a vertical manometer graduated in centimetres of water, taking 5–10 cm as normal. We do not feel that any reading is absolutely correct in that it gives the exact amount of intracranial pressure, but that one can arrive at fairly definite conclusions even though there is some degree of error. In our opinion spinal puncture cannot be used alone as a means of relieving intracranial pressure in every case, but must be combined with a decompression in the higher degrees of sustained pressure. It seems of undoubted value as a means of lowering the intracranial tension and I feel sure that due to its use we are doing fewer decompressions than formerly. We are in the habit of performing punctures as frequently as indicated and withdraw the fluid until the pressure is normal. Not all cases admitted with skull fractures receive punctures, those who are only mildly affected by their injuries and show no evidence of pressure by sign or symptoms are not punctured for fear of producing a meningitis, patients with marked bleeding from the ear, especially if cerebrospinal fluid escapes at the same time, are not punctured unless it is urgently required, for the same reason cases with obvious extradural hemorrhage are never punctured. Viewed from the standpoint of spinal puncture one can arbitrarily group cases as follows:

- 1 Cases with definite evidence of skull fracture but a normal pressure, and no alarming symptoms. Here the fluid is pinkish or clear. One puncture suffices. If the pressure is normal, no fluid is withdrawn.

- 2 Cases with evidence of increased intracranial tension of severe or moderate degree and on whom puncture shows a high pressure (20–30 cm). Following one or more punctures, the signs of pressure diminish and succeeding punctures show a falling pressure. The fluid here is apt to be quite bloody. Punctures are done at intervals until the pressure is normal or the signs no longer are alarming. It is in this class that the puncture finds its greatest therapeutic usefulness and obviates many decompressive operations.

- 3 Cases with marked evidence of intracranial tension and a high pressure on the initial puncture. Subsequent punctures show either no drop in pressure or a rising pressure. Here the puncture is of little value therapeutically, as it accomplishes no lasting reduction in the tension but it is of much value as an indication for some other means of relief of pressure. This is the class of case we treat by decompression.

- 4 Cases with evidence of high intracranial tension and high initial spinal fluid pressure, but in which subsequent taps reveal a low pressure and examination shows no diminution in the severity of the symptoms. Here the symptoms seem to be due to the injury to the brain itself rather than to pressure upon it. Decompression seems of no avail for when the dura is exposed no undue tension is found, and the patient succumbs.

- 5 Cases with marked evidence of pressure with the spinal fluid *clear*,

of small amount, and under high pressure. In these we strongly suspect an extradural hemorrhage and are disinclined to withdraw any fluid. If subsequent examinations show localizing signs or signs of increasing pressure, we decompress rather than take the risk of a spinal tap.

Our views on spinal punctures are summarized as follows:

1. It is not dangerous if properly used.
2. As a therapeutic measure it is of value in selected cases.
3. It may be used to advantage as an indicator of the intracranial pressure and on this, subsequent therapy may be directed.
4. With clear fluid under high pressure we strongly suspect an extradural hemorrhage.

Holbrook¹⁸ uses lumbar puncture as a diagnostic means of determining early increased intracranial pressure and as a therapeutic measure. Fay¹⁹ states its use to be dangerous. Grant²⁰ uses it as does Jackson¹⁴. Sachs²¹ is opposed to its use, having seen two deaths attributable to it. Wilensky¹⁰ in 1919, says lumbar puncture is of no value clinically or therapeutically and in 1921²² states that "lumbar puncture has not given complete satisfaction as a therapeutic measure." Nichols⁹ says "high pressure of spinal fluid, as shown by manometer readings, is of greater value than high blood-pressure as an indication for operation." Ransohoff,¹ in 1910, predicted that lumbar punctures would be used more widely in fractures of the base.

A summary of our experience with lumbar puncture may be given as follows:

Number of patients receiving punctures on admission 178, a mortality of 40 per cent
 Number of patients not punctured on admission 45, with a mortality of 20 per cent
 Bloody fluid obtained in 168 cases with a mortality of 44.3 per cent
 Clear fluid obtained in 12 cases, with a mortality of 8.3 per cent
 Character of fluid not reported 2 cases, mortality 0 per cent
 Initial pressure of fluid 1-10 cm., 18, mortality 4.4 per cent
 Initial pressure of fluid 1-20 cm., 59, mortality 18.6 per cent
 Initial pressure of fluid 20-30 cm., 49, mortality 46 per cent
 Initial pressure of fluid 30-40 cm., 11, mortality 63.4 per cent
 Not recorded, 11

Amount of Fluid Withdrawn on Initial Puncture

1-10 c.c. 14 cases, mortality 57.1 per cent
 10-30 c.c., 83 cases, mortality 32 per cent
 30-50 c.c., 46 cases, mortality 50 per cent
 50-70 c.c., 15 cases, mortality 20 per cent
 75-100 c.c., 5 cases, mortality 60 per cent
 Not recorded, 15 cases, mortality 0 per cent
 Cases with increasing pressure 26, died 14
 Cases with decreasing pressure 29, died 7

Apparently bloody fluid is associated with a higher grade of intracranial damage and a necessarily higher mortality. It is interesting to speculate as to why pressure as low as 1-10 cm. should be associated with such a high mortality as 44 per cent. This could conceivably be due to a filling of the foramen magnum by an oedematous brain stem or blood clot and a consequent

lack of free communication between intracranial and intraspinal chambers, to a leakage of cerebrospinal fluid through fracture lines but most plausibly to serious damage to brain substance without increased intracranial pressure. Naturally the higher pressures are associated with a higher mortality. There seems to be no gross relation between the amount of fluid obtained and the mortality.

The field of usefulness of spinal puncture may well be extended to the post-operative period also. It has been of much help in this respect and we feel that several of our cases have survived after operation due to its employment. The pressure as shown by the bulging, and lack of pulsation of the hernia, is surely temporarily relieved following the puncture. If one assumes that some of the late effects of skull fracture, such as headache, photophobia, mental changes, etc., are due to a continued increased intracranial pressure, it would seem rational to continue the punctures during a patient's convalescence until the pressure is found to be normal. Only recently have we insisted on this, and it will be instructive to follow these cases comparing them as far as possible with those on whom it was not done.

We have frequently been struck by the large amount of fluid one obtains on spinal puncture in some cases of skull fracture. In six of our cases 75-100 cc. were withdrawn on the initial puncture, in 15 cases 50-75 cc., in 46 cases 30-50 cc. Subsequent punctures continue to yield large amounts until within 24 hours one may withdraw as much as 600 cc. of fluid. Whether this is an increased production, a decreased absorption or not true cerebrospinal fluid, we have as yet found no good method of determining.

Extradural Hemorrhage—Of our 223 we have only 9 cases of proven extradural hemorrhage, one of which was disclosed at autopsy in a patient who was not operated upon. Six recovered and three died. Moody²³ reports 100 cases of extradural hemorrhage in 908 cases of skull fracture, and states that 63 were not diagnosed clinically, that 37 cases were subjected to operation and of these 26 died. Phelps¹⁶ reports 34 cases found in a series of 200 fractures of the skull. One should always be on the alert for this type of case for an early diagnosis and operation give the patient his only chance. The history is most important if obtainable, a hemiplegia is strongly suggestive, and a clear fluid under high pressure should serve to put one on his guard. Many observers lay great stress on a single dilated pupil as a valuable sign of extradural hemorrhage and we have found this to be quite true. Peairs²⁴ emphasizes the point that extradural hemorrhage is often accompanied by irritative phenomena rather than by paralysis—this has not been true in our series, in which we have seen paralysis in nearly every instance.

Operations—Operations on the skull for one cause or another have been done for centuries and the procedure of trephining is among the oldest of surgical operations. The first trephinnings for fracture of the skull were done on account of the fracture and without regard to the pressure effects.

upon or injury to the brain itself. This mistaken idea that the fracture was responsible for the signs and symptoms was held until about 1800 since when most observers mention at the beginning of their writings that "it is not the fracture which needs attention, but its effects upon the brain."

The rationale of this procedure seemed to be (1) that a great many of the cases developed abscesses beneath the skull at the site of the fracture and the early trephining was therefore a prophylactic measure, and (2) that extradural hemorrhages could be evacuated. More than one opening was made if found necessary, the openings being made at the site of fracture. It was considered very dangerous to open the dura and this was rarely done. Later the opening of the dura was advised if it bulged through the bone defect, but the opening was closed if possible, thus obviating the decompressive effects of the procedure. Warren²² in fracture of the base advised draining the subdural space with a gauze wick through a trephine opening. Finally, Cushing in 1908 devised the present subtemporal decompression.

Ever since operations for skull fractures have been described there has been much discussion regarding their value. Apparently the profession has formed itself into three groups, one advising operation in nearly all cases, another advising against operation, and a third believing in operation for selected cases. At different periods each of these groups has held the field, at present the pendulum seems to have swung towards conservatism, operations being rarely performed and only when other measures for the relief of pressure (lumbar puncture, hypertonic salt, etc.) have failed.

The subtemporal decompression as described by Cushing is used in this Clinic, the cranial defect being made well down toward the base of the skull. We are in the habit of closing the temporal muscle but not the temporal fascia, as we feel this allows more room for the bulging brain. Fine black silk is used throughout the closure. A rubber tissue drain is inserted down to the base, to act as a continuous avenue of escape for the cerebrospinal fluid. It is removed in forty-eight hours. Since using spinal puncture as a post-operative measure, we have only resorted to a bilateral decompression once. The simple *depressed fractures* are operated on immediately, simple elevation through a trephine hole adjacent to the depression being the method of choice. Many of these fractures cannot be elevated as simply as this, and it becomes necessary to rongeur away portions of the depressed fragments in order to effect a satisfactory elevation. If the dura is uninjured it is not opened, if lacerated, it is opened more widely, the cortex examined, and the dura closed. If there are signs of pressure, a sub-temporal decompression is combined with the elevation. The *compound fractures* are handled by a meticulous debridement of the soft tissues, removal of loose bone fragments, debridement of the lacerated cortex and suture of the pia if possible. If there is much loss of dura so that its closure is impractical a transplant of fascia lata is done from the thigh. The wound is closed completely without drainage. All cases have healed per primam save one in which a superficial skin

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infection developed. The operation is combined with a subtemporal decompression if necessary. This type of case so often decompresses itself through the open wound that one rarely sees the manifestations of increased intracranial pressure associated with them. The extensive osteoplastic flap operation such as one uses for exploratory craniotomies is to our minds not the operation of choice in these acute cases, for it is time consuming and many of the patients do not tolerate loss of blood or prolonged anaesthesia. Frequently we have encountered depressed fractures in old patients who have injuries to the chest and these are easily operated on under local anaesthesia. The cases which were subjected to operation were the most serious ones in the series. Fifty-six cases were operated on as follows:

- 1 Débridement of extensive scalp wounds in cases with linear fractures and no pressure symptoms, 3 cases with no mortality
- 2 Elevation of depressed fractures, 11 cases with 9 per cent mortality
- 3 Elevation of depressed fractures combined with subtemporal decompression, 7 cases with 28.5 per cent mortality
- 4 Subtemporal decompressions in 35 cases of basilar fracture with 45.7 per cent mortality

There were two infections in the series, both in compound fracture, but both superficial and of no real consequence.

Mortality—The total mortality for the entire series which includes all cases of skull fracture, irrespective of other associated injuries, length of time they survived, etc., is 35.8 per cent. Phelps⁴ reports a general mortality of 46.8 per cent in 793 cases, Besley²⁶ 53 per cent in 1000 cases, Harris and Nissen²⁷ 51.3 per cent in 330 cases, Brown²⁸ 29.8 per cent in 100 cases, Wilensky¹⁰ 31 per cent in 75 cases. The analysis of the deaths shows that 14 died in 1 hour or less after admission, 24 died in 1–3 hours, 5 died in from 3–6 hours, 9 died in 6–12 hours, 5 died in 12 hours–1 day, 11 died in 1–2 days, 7 from 2–4 days, 5 from 4–7 days. Four cases died of pneumonia, one from cardiac dilatation. Thus we find that of the 80 deaths 52 occurred in the first 12 hours. These 52 represent that group of cases referred to previously as those who rapidly die in spite of all therapeutic measures. This leaves 171 cases grouped under “those that rapidly recover” and “those whose outcome is problematical.” In these two groups the mortality is 16.3 per cent. In 22 of the 80 deaths there were other severe associated injuries, such as stove-in chests and compound fractures of other bones.

Complications—Of the early complications following skull fracture only three are found in our series: i.e. one case of meningitis, one of persistent facial palsy, and one slight wound infection following operation for compound depressed fracture of the vault. We have not seen sinus thrombosis, arterio-venous aneurism, mastoiditis, brain abscess, aerocoele or other complications.

Treatment—Our comments on the treatment of skull fracture scattered through the preceding paragraphs may be summarized as follows:

1 Depressed fractures or compound fractures, and cases suspected of extradural hemorrhage are operated on immediately

2 All simple fractures except those with very mild symptoms are subjected to lumbar punctures and are carefully observed for variations in pulse, respiration temperature, state of consciousness and neurological signs. If, in spite of the lumbar punctures the pressure is found to be increasing or to remain high, a subtemporal decompression is performed at an early date. Those cases which respond to lumbar puncture are treated by that means.

3 The punctures are done until the pressure is found to be normal and to remain so.

The most important phase of the treatment is the period of observation when one views the changing train of events, weighs the importance of each, and directs his therapy accordingly.

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PARTIAL NEURECTOMY OF THE SENSORY ROOT OF THE GASSERIAN GANGLION IN TRIFACIAL NEURALGIA WITH PRESERVATION OF CORNEAL SENSATION

By ADRIAN S. TAYLOR, M.D.

OF PEKING, CHINA

FROM THE DEPARTMENT OF SURGERY OF THE PEKING UNION MEDICAL COLLEGE

THE modern operation for the relief of major trifacial neuralgia has undergone several stages in its development. The first procedure suggested was to avulse the ganglion itself. This was followed by the avulsion of the posterior root; next it was cut without avulsion, and later it was found to be possible to divide the sensory fibres alone, preserving the motor root to the muscles of mastication. In the early cases a large percentage of the patients showed a post-operative keratitis and many eyes were lost. Since the section of the posterior root as suggested by Spiller¹ in 1901, replaced avulsion either of the ganglion or of the root itself, the incidence of keratitis has fallen, yet Frazier² estimates that it occurs in greater or less degree during immediate convalescence in 10 per cent of all patients subjected to complete sensory root neurectomy, and he feels that in a certain additional percentage, corneal complications develop after the patients leave the hospital. Among the explanations offered for this serious complication are the frequent traumata to an insensitive cornea, the drying of the eye following loss of function of the lacrimal gland, "trophic" changes after injury to the ganglion or to the ophthalmic nerve, and the loss of the protection afforded by the upper lid in those occasional unexplained cases of paralysis of the seventh nerve, and in the disturbance of the little understood sympathetic innervation. Verhoeff⁴ has recently discussed fully the causes of post-operative keratitis and lays stress upon the effect of drying of the cornea. The explanation of the loss of lacrimal function is not clear, as the question of its nerve supply is still unsettled. Verhoeff is inclined to believe that it receives a double supply from the ophthalmic division of the fifth and from the large superficial petrosal branch of the seventh. The innervation from the fifth is of course lost in all complete post-ganglion neurectomies, and from the seventh in complete paralysis of that nerve or of the large petrosal which is easily injured as it passes close to the ganglion.

The problem of preserving the cornea has been an especially acute one in the Peking Clinic because of the fact that many of the patients are poor and are unable to carry out the directions given for the care of the eye after one of the radical operations. The climate of north China is exceedingly dry and cold for many months of the year; high winds are prevalent and the atmosphere is filled with dust. The importance of the preservation of corneal sensation was emphasized by the loss of an eye in a Chinese patient admitted to the ophthalmological service with paralysis of the entire fifth nerve from

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a basal luetic process. This patient was first seen subsequent to the onset of anæsthesia over the whole of the trigeminal area, but before corneal ulceration had occurred. Within two weeks the eye was lost notwithstanding hospital care by the eye service. Two European patients soon afterwards came under observation with "epidemic" or infectious ganglionitis and both showed partial anæsthesia of the cornea with corneal herpes. Fortunately both recovered without serious scarring of the cornea.

In the discussion of this problem, the suggestion came from A. H. Woods in charge of neurology in Peking, that an attempt be made in suitable cases to divide partially the posterior root severing only those fibres supplying the second and third divisions of the nerve conserving at least a part of the bundle of fibres which make up the first division. He called attention to the fact that in every large nerve the component fasciculi occupy definite positions in the nerve trunk, and pointed out that the fibres in the posterior root of the trigeminal supplying each main division of the nerve always lie in fixed positions, those fibres supplying the first division being found above and medially, those to the second branch next, and those to the third lowest and most lateral. The possibility of identifying and preserving the motor root has been recognized for a number of years.

The procedure suggested by Woods was carried out by the writer in three cases in Peking before return to America recently on furlough, when Frazier's^{2,3} communications were first seen. In his last he reports twenty-five cases of subtotal neurectomy done during the past ten years with complete relief and without recurrence of the neuralgia or corneal complication in any instance. Frazier discusses the anatomical and physiological basis for the operation, and in a personal communication he mentions unpublished work in the embryology of the nerve which shows that the first division develops as a separate nerve. The results in subtotal division of the posterior root of the ganglion indicate that the function of the ophthalmic division may be retained after permanent destruction of the second and third branches.

The technic employed in the cases of trifacial neuralgia in Peking does not differ from the standardized operation. Thorough exposure in a dry field must be secured and Adson's lighted retractor has been found helpful. The middle meningeal artery is controlled by plugging the foramen spinosum with pledgets of cotton and bone wax before the artery is divided. The distal end of the artery is ligated with fine silk. A reliable clip would greatly simplify matters at this point, but the instruments available in Peking are unsatisfactory, and a new instrument is being devised to carry a short strip of a narrow silver ribbon like a miniature skin clip instead of the usual short piece of round wire which has such a discouraging tendency to slip and roll and fall off at inopportune moments. After thorough exposure of the sensory root is obtained a short right-angled blunt hook is passed from below upward and inward beneath the fibres running through the ganglion to the third division. These are elevated the motor root beneath identified and preserved and the fibres held by the hook are sharply divided with a short right-angled

knife blade Adson's guillotine would be useful here Those fibres going to the second division are then visualized lifted up and divided To make sure of the complete division of all posterior fibres to the second branch the section is carried just into the fasciculi running to the ophthalmic nerve

As the neuralgia in the three patients operated upon was most pronounced in the maxillary nerve the second division itself was cut distal to the ganglion in order to assure division of all of the fibres going into it The peripheral end was avulsed and the foramen rotundum was plugged with silver foil as an added precaution against regeneration The third branch was not disturbed distal to the ganglion but in all cases anaesthesia was complete over its distribution The possibility of central branch fibres remaining undivided with the danger of recurrence of the neuralgia or of its extension into the previously uninvolved first branch is recognized but the risk appeared justifiable because of the greater hazard to an insensitive eye Frazier's report shows that one may be sure of the complete division of the second branch centrally, thus making unnecessary its section distal to the ganglion In any type of operation, trauma to the ganglion should be avoided, and the first branch should never be cut distally as connection between cornea and its undisturbed ganglionic cells through untraumatized nerve fibres is held to be important in preventing "trophic" change

Sufficient time has not elapsed to justify a personal evaluation of the method, but Frazier's report justifies the hope that the relief afforded may be permanent

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PERSISTENT AND RECURRENT HYPERTHYROIDISM

By FRANK H. LAHEY, M.D.

AND

HOWARD M. CLUTE, M.D.

OF BOSTON, MASS.

FORTY-EIGHT cases of persistent or recurrent primary hyperthyroidism have required secondary or repeated operations in the Lahey Clinic to remove their thyroid toxæmia. Of this group of 48 cases 29 had been previously operated upon in this Clinic and 19 had had their primary operative procedures elsewhere.

Of the 48 cases that have had secondary thyroidectomies, the records are incomplete in 24. This is due to the fact that 19 of these cases were previously seen in other clinics and the remaining five cases have incomplete records of their early treatment. In these 24 cases, certain facts can be ascertained from such data as we possess. The average time elapsing between their first operation and their visit to the Clinic was four years. The longest interval between operations was ten years and the shortest period, one year. It is not known whether these patients were toxic during this interval or whether their disease was quiescent.

Before their second admission these 24 patients had had 32 operations performed on the thyroid gland. These operations were performed as many as ten or more years ago in some cases, and were undoubtedly of a different character than the procedure followed at the present time. In certain cases pole ligation, combined with hot water injections, had been performed. When part of the thyroid gland was removed, a much greater proportion was undoubtedly left behind at that time than is now deemed advisable. In many cases a hemithyroidectomy alone was performed.

The average metabolic rate of this group of 24 cases on admission for further treatment was 158 per cent. Their subsequent treatment consisted primarily in the further removal of thyroid tissue such as hemithyroidectomy or subtotal thyroidectomy.

On discharge from the Clinic the average metabolic rate of this group was 28 per cent. Thirteen of the 24 cases had a normal rate within six months after discharge, 9 have not been heard from and 2 are still definitely toxic.

The average age of this group at the time of their first operation was thirty-seven, the youngest being twenty-one and the oldest being fifty-five.

No positive conclusions can be drawn from this group. We have the impression that in the majority of these cases their original toxicity while possibly improved was not cured by their first operation. They doubtless had been suffering from thyroid toxicity during the entire interval preceding

their secondary operations. In no cases did we fail to find a good-sized piece of hyperplastic thyroid gland in the neck.

There now remain 24 cases of primary hyperthyroidism who have returned for secondary operation in whom our records are for the most part complete from the first of their illness to the present time. Study of this group of patients shows that they fall readily into two main divisions. In the first class are 19 patients whose metabolism never came to normal after their first series of operations, although clinically they were improved by their operative treatment. In the second group are five patients who were clinically cured after their first series of operations and left the hospital with a normal metabolic rate to come back later with a return of symptoms and high rate. The patients in the first group may be said to have had persistent hyperthyroidism and those in the second group recurrent hyperthyroidism.

The average metabolic rate of the 19 patients having persistent hyperthyroidism was 75 per cent at their original admission to the Clinic. Several

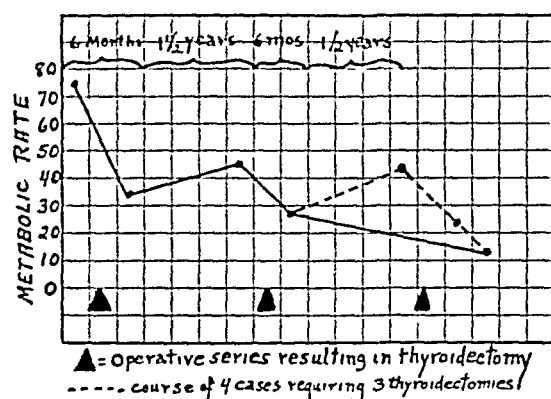


FIG. 1.—Course of the average metabolic rate in nineteen cases of persistent hyperthyroidism. Note that the rate never came to normal until after the second or third subtotal thyroidectomy. In the four cases shown with the dotted lines a third thyroidectomy was done. The average rate for the group at discharge was 14.

of this group were as seriously ill as any thyrotoxic patients we have treated. All were treated by multiple stage operations. After the first operative series the average rate for the group was 34 per cent. Check up metabolisms were done after each operative series in all these patients whenever possible, as is our custom in treating all cases of hyperthyroidism, and attempts were made to reoperate those cases having a persistent high metabolic rate. The average interval between the first and second operative series in this group was one and one-half years. When these patients were admitted for their second operative series their average metabolic rate was 45 per cent. After this second series was completed the rate on discharge averaged for the group 28 per cent.

In 4 cases in this group of persistent hyperthyroidism patients a third subtotal thyroidectomy was performed. The average rate for the group before their third operation was 42 per cent. On discharge this had dropped to 25 per cent. For the entire group the last metabolism estimation available, which in nearly every case is several months after the final operation, averages 14 per cent. Two patients are still slightly toxic, showing both by clinical signs and an increased metabolic rate that they are not yet cured. One of these has had two subtotal thyroidectomies and the other three subtotal thyroidectomies. The average age of the 19 patients in this group having persistent hyperthyroidism at the time of their first operation was thirty-two. The youngest was sixteen and the oldest fifty.

Lugol's solution has been used repeatedly in this group of patients during the past two years. In many cases the metabolic rate has dropped to normal after its use. Persistence in following up the patient, however, has demonstrated that this was not a permanent drop in rate. In no case of hyperthyroidism persisting after thyroidectomy that we have followed has Lugol's maintained the metabolic rate at normal. Our experience with these patients demonstrates very clearly that failure of the rate to return to normal within two or three months after operation is always due to the presence of too much hyperplastic thyroid tissue in the neck. We still believe that it is worth while to administer Lugol's solution to these patients in the hope that some one may be permanently benefited. We are certain, however, that patients with high metabolic rates after thyroidectomy must be warned of the probable necessity of further operative removal of thyroid tissue unless the rate reaches and remains normal in eight to twelve months.

In the final group of patients we have five women who were apparently cured of their thyroidism but suffered a recurrence of the disease. The average metabolic rate for this group of patients on their first admission to the Clinic was +68. After the first series of operative measures they were discharged from further treatment with a metabolic rate averaging -5. The highest rate of the group on discharge being +14 and the lowest being +4. An interval then occurred in which these patients were definitely free from symptoms. The average length of this period was two years. In three cases it was three years and in one case only a few months passed before the rate again began to increase and the patient showed evidence of returning toxicity. The average metabolic rate before the second series of operations in this group was +45 per cent, which fell after operation to -9 per cent.

The average age of these five patients at the time of their first operation was thirty-one; the oldest was thirty-nine and the youngest was twenty-two.

Four of these five patients took large amounts of Lugol's solution over a period of weeks or months. In each patient some temporary clinical improvement was obtained, but in no case did the metabolic rate remain normal or the clinical evidence of thyroid toxicity permanently disappear.

In these 48 cases of recurrent or persistent hyperthyroidism we have never failed to find a good-sized piece of thyroid tissue in the neck at the second operation. We have a distinct impression that the tendency of the occasional thyroid operator is to leave too much thyroid rather than to remove too much.

In four patients in the series there occurred clinically a very definite

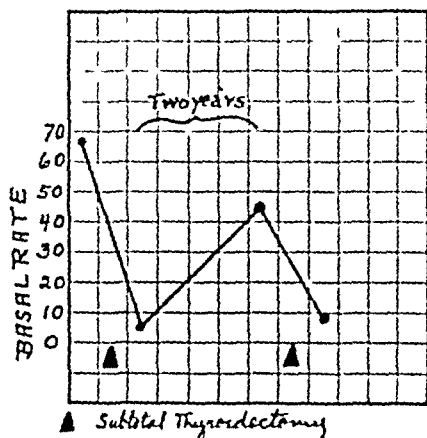


FIG. 2.—Slowing course of metabolic rate, in group of five cases of recurrent hyperthyroidism. Apparent cure six months to a year after first subtotal thyroidectomy. Return of high rate and symptoms of thyroid toxicity after two year interval. Second apparent cure by thyroidectomy.

hypertrophy of the small remnants of thyroid tissue left at the first operation. At the secondary operations in these cases new lobes as large or even larger than the original ones, were found. One of these had received large amounts of iodine medication but this did not prevent the recurrence of large pieces of thyroid on two occasions. This woman has had three subtotal thyroidectomies, her metabolic rate is still elevated, she is clinically still toxic, and a definite enlargement of the left lobe is once more becoming evident.

It is frequently very difficult to palpate any thyroid tissue in the neck upon which a previous thyroidectomy has been performed. We have repeatedly been surprised at the size of the thyroid remnant in cases where none could be palpated. We are convinced that in the presence of a persistently increased metabolic rate and clinical evidence of persistent or recurrent thyroid toxicity reoperation should be advised. The fact that no large piece

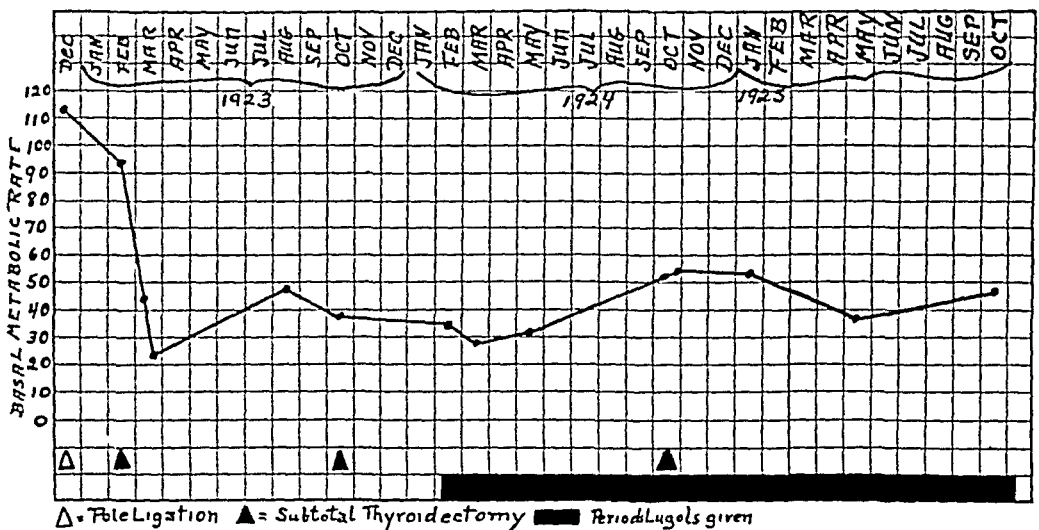


FIG 3—Female aged fifty. Severely toxic primary hyperthyroidism. At each of the three subtotal thyroidectomies large pieces of thyroid tissue have been removed. Note that long continued use of Lugol's solution has neither lowered the metabolic rate nor prevented recurrence of hyperplasia of the thyroid remnants. Patient still toxic when last seen and a large hyperplastic lobe can again be felt on the left side of the neck.

of thyroid tissue can be felt through the scar of the previous operation is no evidence that a large segment of thyroid is not still present and overfunctioning.

There have been no deaths in this group of 48 patients. There have been no hemorrhages. No case of tetany has occurred and, insofar as we know, there has been no post-operative paralysis of the recurrent laryngeal nerves.

The reoperation upon patients upon whom a previous inadequate subtotal thyroidectomy has been done is a much more difficult and trying procedure by far than subtotal thyroidectomy upon a thyroid upon which no previous operative procedures have been carried out. Bleeding is profuse and of the oozing type; the prethyroid muscles are adherent to the gland, the great vessels are likewise adherent to the gland and anatomical relations are greatly disturbed. Due to these factors, to the profuse bleeding and to the trying difficulties of the procedure unless definite and logical steps are at one's

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command, small and again inadequate amounts of thyroid tissue will be removed and the thyroidism will persist

In our experience with these 48 cases of recurrent or persisting thyroidism we have gradually devised a technic which permits of exposure of the entire persisting segment of thyroid tissue on either side of the neck. With this method it is just as possible as in an original subtotal thyroidectomy in a case of primary hyperthyroidism, to observe the entire segment to mark off with hemostats the part to be left behind and to excise that portion which is to be removed by the same technic as was described by one of us in *Surgery, Gynecology and*

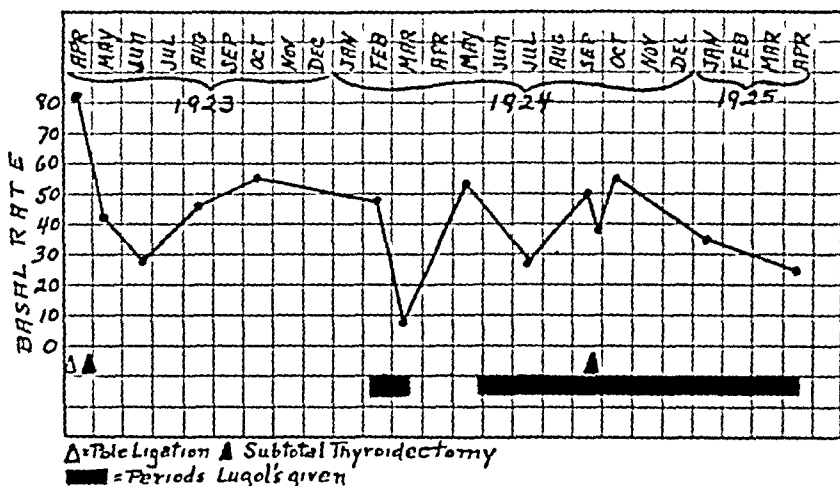


FIG. 4.—Male aged thirty-four. Course of metabolism over period of two years in severe case of persistent primary hyperthyroidism. Note in February 1923 the use of Lugol's solution caused rate to drop. Rate then returned to old level when iodine was stopped. Later administration failed to cause a permanent lowering of metabolic rate. At second operation a large piece of thyroid tissue was found in the neck.

Obstetrics for June, 1923

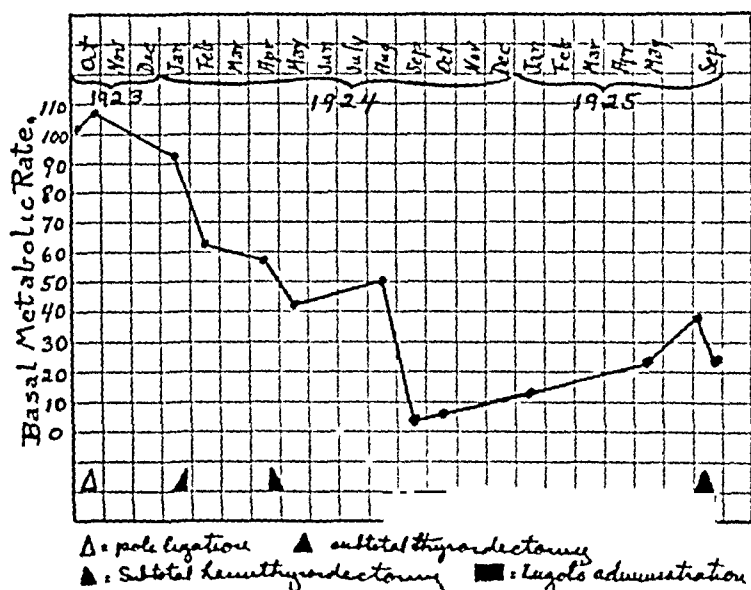


FIG. 5.—Male aged fifty. Note metabolic rate failed to return normal after two hemithyroidectomies. With use of Lugol's solution rate came to normal and symptoms of toxicity though still present were improved for a time. In eight months patient was clinically very toxic and his metabolic rate was again elevated to +40. A second thyroidectomy was done on this patient with the removal of a very large piece of hyperplastic thyroid tissue and marked clinical improvement. No marked metabolic rate change has yet occurred since this operation.

cut between clamps just as in the original operation. The cut muscles being retracted upward and downward the segment of thyroid then comes into view.

Close inspection of the thyroid remnant will now show that it is bound

firmly in its bed by numerous adhesions. The anterior adhesions having been cut in the detachment of the anterior muscles, those remaining will be between the outer surface of the gland and the internal jugular vein and the sternomastoid muscle. It is by dealing with these adhesions satisfactorily that we have been able to expose and remove or leave behind any proportion of the persisting thyroid tissue no matter how numerous or dense the adhesions that we dissect. The entire success of adequate reoperation upon remnants of thyroid glands is dependent upon complete freeing of the internal jugular vein and common carotid artery from the thyroid remnant and wide retraction

of those vessels outward.

This having been accomplished a double hook may be introduced into the remnant, it may be elevated from its bed and as much removed and as much left behind as one desires. Fortunately adhesions do not exist on the posterior surface of the gland, and when the large vessels are freed, no difficulty is experienced in elevating the remnant.

The dissection of the internal jugular is best begun above the stump of remaining thyroid tissue, the vessel being identified and followed

FIG. 6.—Exposure of residual thyroid tissue in secondary thyroidectomy. Note adhesions to internal jugular vein. These must be separated completely to permit full exposure of the thyroid remnant.

down to where it becomes adherent to the thyroid remnant. By gentle dissection with blunt scissors it may be quite rapidly separated from the gland with remarkably little bleeding. In the entire 48 cases we have had no trouble with the internal jugular and it has not required ligation in any case.

The parathyroids and recurrent laryngeal nerves are protected by leaving behind a thin strip of thyroid tissue as in an original subtotal thyroidectomy.

In no cases with the aid of this technic have we failed to fully expose the thyroid remnants regardless of the previous operative procedures. Several of the cases as has already been stated, had had injections of boiling water, previous to the original subtotal thyroidectomy which preceded our operations upon the remnants, and in one case the neck had been so deeply burned by X-ray that skin, prethyroid muscles and thyroid gland were replaced almost completely by firm fibrous tissue, persisting and overfunctioning islands of thyroid tissue, however, still resulting in an intense hyperthyroidism.

CONCLUSIONS

Following subtotal thyroidectomy persistence of symptoms of hyperthyroidism together with persistence of a basal metabolic rate above normal, indicates that there still remains a segment of hyperfunctioning gland capable of producing hyperthyroidism

Removal of a very large proportion of this segment by reoperation will in a majority of instances bring about a cure

The administration of Lugol's solution to these cases even over a period of months, has failed to produce a single cure

The essential factor in the reoperation of these cases is the separation and retraction of the internal jugular vein and the common carotid artery from the thyroid remnant. With this done any amount of thyroid tissue desired may be removed from the thyroid remnant

OSTEOMYELITIS OF THE STERNUM

By ABRAHAM O. WILENSKY, M.D.

AND

SAUL S. SAMUELS, M.D.

OF NEW YORK, N. Y.

FROM THE MOUNT SINAI HOSPITAL OF NEW YORK AND THE
BROOKLYN AND EAST NEW YORK HOSPITAL OF BROOKLYN

IN a previous communication by one of us (Wilensky) the mechanism of acute infection of bone—osteomyelitis—was extensively discussed. The present paper concerns itself with osteomyelitis of the sternum, a rather uncommon form of this disease. The principles of the mechanism of osteomyelitis in general as previously described, will be incorporated in this communication as it applies to osteomyelitis of the sternum, and the phenomena and extraordinary features of pyogenic infection of the latter bone will be found to be entirely explainable on the essential mechanism described.

The last comprehensive report on osteomyelitis of the sternum is one by Drews and appeared in 1910. Drews was able to collect only 12 cases from the literature up to that time, and reported an additional case from Muller's Clinic. A more thorough search, however, has since brought to light 5 more cases reported prior to 1910 and 2 cases reported since last year, making with the 3 we shall describe, a total of 23 cases reported to date.

Henschen in Von Bergman and Brun's system, estimates the relative occurrence of osteomyelitis of the sternum as one-third of one per cent of all forms of osteomyelitis. In the last ten years there have been treated at the Mount Sinai Hospital 578 cases of osteomyelitis of all kinds and varieties. Among these there were only two cases of osteomyelitis of the sternum, the percentage relation is the same as the estimation of Henschen. At the Brownsville and East New York Hospital, there has been admitted in the last four years 54 cases of osteomyelitis. Among these there has been only one case of osteomyelitis of the sternum, the percentage relation is 1.8 per cent, which is considerably higher and is explainable on the relative shortness of the time interval and the smaller number of cases in the series. The important fact to be noted is that the sternum is one of the bones of the body which is least apt to be involved as a secondary and subsidiary focus in general infections and one in which a thrombo-embolic lesion is least apt to develop into a fixation point.

Henschen estimates the mortality of osteomyelitis of the sternum as 50 per cent. Of the 11 cases we shall note, besides the 13 of Drew's, 3 died and 8 recovered giving a mortality of 27 per cent.

CASE REPORTS

CASE I—Male, twenty-four years old. Five months before admission to the hospital the patient had had a bilateral pneumonia. On the tenth day of the pneumonia, a nodule appeared over the upper part of the sternum which soon opened spontaneously and dis-

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charged pus. The resulting wound, at approximately the junction of the manubrium and the gladiolus has been discharging ever since. At the radical operation a partial and local resection of the sternum was done (Doctor Wilensky). The skin around the sinus was excised, and a piece of the gladiolus through which the sinus ran was resected. The sinus went right through the bone. The posterior periosteum and anterior mediastinum was intact. The wound was sutured with a small drain at one end and this was followed by primary union. After healing of the wound an X-ray picture showed a defect at the junction of the manubrium and the gladiolus. The Wassermann reaction was negative.

CASE II—Female, thirty-five years old. Five years previously the patient had had typhoid (?) fever. Two years previously an abscess of the thigh was incised and the resulting wound continued to discharge until one month before the present admission to the hospital. Six weeks before the present admission to the hospital, the patient developed a "cold" with pain in the chest. At this time she noticed a lump over the sternum which progressively increased in size. There was no malaise or fever.

It was demonstrated at operation that a large abscess was present over the upper end of the sternum which contained several ounces of pus. On exposing the bone a sinus was found at the right border of the sternum between the first and second ribs, which admitted a fine probe for one-half inch. The abscess cavity was emptied and the sinus was thoroughly curetted. Healing followed. Doctor Moschcowitz operated upon this patient, we are indebted to him for permission to use these notes.

The Widal reaction was negative. The Wassermann reaction was negative. The pus from the abscess contained paratyphoid bacilli B, but agglutination tests with B typhosus and paratyphoid A and B bacilli were negative in dilutions of 1 to 50 to 1 to 6000. Duodenal contents contained no paratyphoid bacilli. The urine and stools contained no typhoid or paratyphoid bacilli. No tubercle bacilli were found in the pus.

CASE III—Male, twenty-four years old. Four years before the present admission to the hospital the patient was struck over the sternum while playing football. There was some tenderness over the sternum but no other symptoms and the tenderness subsequently disappeared. Six months later the patient began to have pain over the sternum and an abscess developed which was incised and drained. There have been numerous recurrences of this abscess formation in the last eighteen months.

At the time of admission to the hospital a funnel-shaped sinus was present over the middle of the sternum at approximately its junction with the third costal cartilage. Surrounding this there was an area of inflammation occupying about one-half of the chest wall, in abscess was present.

The abscess was first incised and drained, bare bone was felt at the bottom of the abscess. Two weeks later the radical operation was done (Doctor Wilensky). A sinus was found extending through the sternum into the anterior mediastinum. The second and third costal cartilages were involved in the inflammatory focus. The entire extent of the sternum which was involved in the focus was excised and with it the entire second and third costal cartilages. There was considerable scarring of the posterior periosteum of the sternum and of the connective tissues of the anterior mediastinum. A brisk hemorrhage from the internal mammary artery was controlled by suture. The resulting wound was picked wide open. Healing took place slowly.

CASE IV—Six days before admission to the hospital, the patient—a child of eight years was struck in the chest by the elbow of a playmate. On the next day pain was felt in the region of the sternum. Three days later the pain was more severe and the temperature had risen to 103°F . On the next day the temperature had reached 106°F and the child became delirious.

At the time of admission there was a red tender area over the sternum at the level of the fifth rib. There was some question as to the presence of a pneumonia on the right side, the roentgenographic examination of the lungs was however negative. There were 12,000 white blood cells to the cubic millimetre with a differential polymorphonuclear count of 86 per cent. On the second day after admission the general condition of the child

grew rapidly worse. A cultivation of the peripheral blood showed 300 colonies of staphylococcus aureus to the cubic centimetre of blood.

Doctor Klingenstein operated upon this patient. A focus was demonstrated to be present in the body of the sternum at the level of the third rib, which reached over and involved the costo-sternal articulation. There was no perforation into the pleura although the anterior mediastinum was involved.

The child died soon after the operation. There was no post-mortem examination.

CASES FROM THE LITERATURE

CASE V—Drews' case was in a young adult. The entire manubrium was found lying unattached in the middle of an abscess cavity. There were no blood culture studies, but the pus contained staphylococcus aureus. The patient recovered.

Drews' report contains the following cases from the literature previous to 1910.

CASE VI—Solomon's case also occurred in a young adult, there was a fatal issue. There was coincident involvement of the right sterno-clavicular joint and pulmonary symptoms. The post-mortem examination showed involvement of the manubrium and the gladiolus to about its middle, a retrosternal abscess in the anterior mediastinum, a right sterno-clavicular suppurative arthritis. No blood culture study was made, but, from the character of the clinical course, a bacteriæmia must have been present.

Sick's cases included the following.

CASE VII—A nine-year-old boy had an osteomyelitis limited to the body of the sternum between the second and fifth ribs, a perforation was present into the mediastinum. There was a fatal issue. The post-mortem examination showed multiple foci in the femur, radius and lungs. No blood culture studies were reported, undoubtedly, however, a bacteriæmia must have been present at some time.

CASE VIII—A sixteen-year-old boy had an acute osteomyelitis of the entire body of the sternum with fatal issue. The post-mortem examination showed in addition a fibrinous pericarditis, a bilateral hemorrhagic pleuritis, a liver abscess, and a purulent peritonitis. The manubrium was intact. This is a typical example of a general infection. It is difficult to make out from the published report whether the pericarditis and pleuritis were due to direct extension of the infection by contiguity of tissue or by perforation, or whether they represented metastatic foci. There are no blood culture studies on record.

CASE IX—A fifteen-year-old girl had an osteomyelitis of the body of the sternum with a subperiosteal abscess. A recovery was made.

CASE X—A twenty-one-year-old man had an osteomyelitis of the upper part of the body of the sternum with a subperiosteal abscess. There was a secondary focus in the right wrist-joint. A recovery followed.

Neither of the last two cases had blood culture or other bacteriological studies.

CASE XI—von Tungal's case was referred to by von Bergman. An eighteen-year-old man died five days after the onset of a severe acute general infection. No localizing foci were discovered during life. The post-mortem examination showed multiple hemorrhages in the heart muscle, several bone foci in the femur and acromion and a focus in the lower end of the sternum. No blood culture studies were reported.

CASE XII—Jochman's case was in a seventeen-year-old boy. The patient died two days after the onset of a fulminant acute general infection. A focus was present involving the sternum and the contiguous portion of one of the ribs, an abscess had developed which had broken through into the anterior mediastinum. No blood culture or other bacteriological studies were reported.

CASE XIII—Muhlein's case was in a twenty-two-year-old man. An abscess developed in the synchondrosis between the manubrium and the gladiolus. The post-mortem examination showed in addition a lung abscess and a splenic tumor.

CASE XIV—Korte's case was in a young girl of eighteen years in whom at the post-mortem examination it was demonstrated that a purulent mediastinitis had complicated

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an osteomyelitis of the manubrium and gladiolus, a pericarditis was also present. In spite of the fact that there were manifestations of a severe general infection, it seems more probable that the mediastinitis and pericarditis had occurred by direct extension of the focus. No blood culture or other bacteriological studies were reported.

CASE XV—Albertin's case occurred in a young adult and followed typhus fever. Four other cases developed rib foci after typhus fever. There are insufficient data in the report.

CASE XVI—von Thiem's case was a twenty-six-year-old woman. The lesion followed the severe exertion of threshing grain. There are insufficient data in the report.

CASE XVII—Batut's case was a twenty-two-year-old sailor. Three months after typhoid, he noticed a swelling over the sternum at the level of the third and fourth ribs, this was incised and the sternum was curetted, healing followed. Two months later the swelling reappeared and numerous fistulae formed, these were curetted. New fistulae appeared near the xiphoid two weeks later which extended to the sternum. The condition was treated conservatively. A more radical operation was contemplated but the patient objected and disappeared from observation. No bacteriological studies were reported.

CASE XVIII—Vaughn's case was a twenty-six-year-old man. There was no history of trauma and a gradual onset with pain in the chest over the upper part of the sternum. Four days after the onset of symptoms a swelling appeared in the latter location. The swelling was explored on the sixth day; the upper middle portion of the sternum was found to be involved in an osteomyelitic focus, the periosteum was thickened but stripped easily. The anterior cortex and medulla was cleared out as far as the posterior cortex. The anterior mediastinum was not involved. The wound was packed wide open, healing took place and a recovery followed. The sterno-clavicular and sternochondral joints were not involved.

CASE XIX—Peloquin, Peradon and Vogelín report a case which occurred seventeen months after an attack of paratyphoid fever. Persistent sinuses formed which led to the sternum. Four operative revisions were necessary. Vaccines were used. Finally the patient succumbed to a pleuro-pneumonia. The sputum contained paratyphoid bacilli and streptococci.

CASE XX—Merchant's case in a forty-one-year-old man. There was a sudden onset with pain in the chest, chill and fever. A general infection was present. A localization occurred over the sternum and seven days after the onset an incision was made over the bone. There was complete involvement of the sternum down to the xiphoid with complete separation of the first and second portions of the gladiolus. On inserting a finger behind the sternum, respiratory movements were felt. Secondary fracture occurred and was due to bone necrosis. Death occurred after sixteen days.

The post-mortem examination showed the following: (1) Right encapsulated empyema, (2) small left pleural effusion, (3) subcutaneous abscesses over the sternum, (4) congestion of the lungs, (5) sequestration of the sternum, (6) suppurative chondro-sternal arthritides, (7) dense adhesions of posterior periosteum to pericardium and mediastinal pleural (no perforation).

CASE XXI—In Bidwell's case a swelling appeared over the sterno-clavicular joint two weeks before admission which contained pus. This was followed by dyspnoea and a depression formed at the site of the sternal swelling. On the next day there was a discharge of pus from the aspiration opening and the child died four days later. The autopsy showed a pus sac the size of a walnut overlying the upper part of the breast bone, on opening the sac the upper part of the gladiolus and the lower part of the manubrium were found to be absent. The cavity communicated with the left sterno-clavicular joint and with the anterior mediastinum. The umbilical vein was filled with pus. A liver abscess was present also.

CASE XXII—Koch's case was a thirty-year-old man. There was a sudden onset with epigastric pains and high fever. A diagnosis of pneumonia was made. After nine days the pain localized to the sternum and a fluctuating mass soon appeared over the

ensiform process This was incised Two days later another abscess formed near the right breast, which was also incised From both of these, fistulæ developed Five weeks after the onset, a radical operation was done The sternum from the second to the sixth ribs were completely riddled with abscesses, to which the fistulæ extended The pericardium and the mediastinum were exposed after the removal of the necrosed sternum, and were found to be covered with granulations The pus contained staphylococci No blood cultures were reported The patient recovered

CASE XXIII—Janz's case was in a twenty-one-year-old soldier There was a sudden onset with fever, chill and pain in the chest A diagnosis of pneumonia was made Three days later a tender swelling appeared over the sternum One week after the onset an incision was made over the sternum After going through the skin, a large amount of pus escaped from the depths at the level of the second and third ribs The periosteum was thickened The corpus sterni was intact, but there was a separation of the corpus and the manubrium There was a large cavity behind the sternum in the anterior mediastinum about the size of a fist The pericardium was visible at the bottom of the cavity The pericardium, pleura and lungs were not involved The sterno-chondral and sterno-clavicular joints were not involved

CASE XXIV—Busch's case was in an eighteen-year-old girl A purulent anterior mediastinitis followed an osteomyelitis of the sternum (manubrium and corpus) Both sterno-clavicular joints were involved and they as well as the manubrium and corpus were resected A pericarditis was also present

One year after operation, the patient was presented as a completely recovered case with hardly any change in the shape of the thorax or interference with the stability of the shoulder girdle

In previous communications the mechanism of bacterial infection in general, and of osteomyelitis in particular, were extensively discussed As far as these observations apply to osteomyelitis of the sternum, it suffices to summarize them as follows

The ordinary case of acute osteomyelitis results from a bacteriæmia or general blood infection, the origin of which is in the greatest number of cases obscure In these cases it is thought that the entry point of the infection must necessarily be some surface (skin or alimentary canal) of the body, in actual practice it is assumed that, with very few exceptions (genito-urinary infections, furuncular infections of the skin, this surface is the mucous membrane lining of the alimentary canal at points where collections of lymph-adenoid tissue are especially prominent (tonsils, especially, Peyer's patches, etc) At the latter areas a lesion need not necessarily be demonstrable In a small minority the bacteriæmia or general blood infection accompanies or follows a definite entity such as a pneumonia or a definite focus of infection is present somewhere in the body—phlebitis, post-partum sepsis, a furunculosis, etc,—to which the bacteriæmia or general blood infection is subsidiary and through which in turn the osteomyelitis originates One of the cases reported by us here belongs in this latter group, the sternal lesion having followed a paratyphoid infection

In any case the focus in the sternum is a fixation point to which the bacteria circulating in the blood are attracted, commonly only a single one of these fixation points develops in the sternum When the number of subsidiary foci which develop following the original bacteriæmia or general blood infection is more than one, some of the fixation points may be located

in other tissues and structures, as for instance, in another bone or joint. Examples of these are to be found among the cases reported herewith. The possibility of any of these subsidiary lesions in turn, forming a point of distribution from which a bacteraemia or general blood infection may occur and from which subsidiary foci can develop in exactly the same way, were fully discussed on several other occasions by one of us.

The bacteraemia through which joint infections become established and develop are not always demonstrable. It is well known that these states may be of temporary duration, that they occur during apparent health as well as during disease, that the natural forces of the body are usually amply sufficient to overcome these so promptly that no evidence of their presence is perceptible in any way, and that in exceptional cases, when these protective factors break down, the presence of bacteria in the blood, even for these short periods is sufficient to infect any locality. While in extraordinary circumstances it may be possible for bacteria to pass through a surface of the body (tonsils, for instance) and multiply in the blood, the available knowledge seems to show that ordinarily bacteria circulating in the blood depend for their existence there primarily upon the presence of an infected thrombus. Then the course of events is one of two. (1) Microscopic pieces of the thrombus carrying a number of living organisms break off and circulate through the blood stream or isolated organisms growing on the surface of the thrombus or groups of them in the forms of bacterial emboli, are cast off into the blood stream. In the small minority of these instances in which the natural antibodies are not sufficient to destroy the organisms as fast as they are discharged into the circulation the infected thrombus-embolus becomes caught into the capillary network of the sternum, and becomes a fixation point and furnishes the initial stage of a focus of osteomyelitis. (2) In addition to the preceding the virulence of the bacteria may be sufficient to enable them to multiply in the blood stream.

The physical characteristics of the infected thrombus-embolus formation (fixation point) the consequent disturbances of the local circulation and its resultant effects on the tissues of the sternum have direct effects on the clinical and pathological anatomical picture.

A fixation point is formed by the arresting or location of a thrombus-embolus at some point of the vascular network of the sternum. The actual point depends more on chance than on anything else, and is decided by the physics of the local bone circulation at the given moment. Various pathological pictures result, depending on the size of the plugged vessel the relative position of the plug, the powers of vascular anastomosis etc., in conjunction with the character, virulence, etc., of the bacteria giving rise to the infection. The dominant characteristics of the pathological pictures are (1) A thrombo-arteritis or thrombophlebitis, and (2) a necrosis of bone and cartilage cells consequent to the disturbance of circulation. The physical characteristics of the pathological picture depend to the largest extent upon the second factor.

In actual disease the position of fixation points are probably determined

by some kind of local trauma at the given point. This has been extensively referred to on several previous occasions. I include under the general term of trauma all varieties—mechanical and physical trauma, chemical trauma, etc. In clinical experience the cases group themselves into (a) those in which there is a distinct history of a definite physical trauma, and (b) those in which no such history is elicitable.

The physical basis for the predisposing effect of trauma consists in the tearing of some of the vessels and in a consequent gross or microscopic hæmatoma associated with blocking and slowing of the local circulation at one or more points, this is a fixation point in the sense that any living organisms floating in the circulation can and may be arrested at the point blocked and develop there. Trauma was an important factor in one of the cases reported in this paper.

The sternum—including its three divisions—is composed of delicate cancellous tissue, covered by a thin layer of compact tissue the latter being thickest in the manubrium between the articular facets for the clavicles. Although preformed in cartilage the finished structure approximates that of bones which are developed in membrane. Because of this the physical characteristics of the circulation in the sternum is an important factor in the occurrence of foci of infection within the bone.

The blood supply of the sternum does not originate from any single vessel. Numerous vessels derived, from muscular and other branches in the muscles and tissues attached to the sternum or derived from larger trunks nearby—the internal mammary vessels—perforate the three divisions of the sternum and supply it with blood. The vascular network within the sternum resembles that of other flat bones and is of the periosteal type. The extensive anastomosing network in the periosteum of the sternum sends down short branches into the cancellous tissue of the sternum which resemble in their structure and distribution the Sharpey's fibres of the long bones. Apparently there are no end vessels such as one finds towards the avascular areas of the long bones.

Because of these circumstances thrombo-embolic formations occur as one of two manifestations. In the one kind the focus develops between the periosteal membrane and the external compact layer of the sternum. Subperiosteal abscesses result and are quite common, they are illustrated in the cases quoted or reported in this communication. The periosteum of the sternum is very firm and strong and the path of least resistance for the purulent collection is between it and the underlying bone, so that quite frequently the progressive accumulations of pus causes a dissection of the sternal segments from their ensheathing periosteum. This is seen frequently clinically and is illustrated in some of the cases reported herewith in which it is described that one or other of the sternal divisions was found free in a large abscess. As in the bones of the skull the dissection is limited at the synchondroses, any further accumulation results in perforations, in front, into the subcutaneous tissue, and, behind, into the thorax. The segment of

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bone lying free in the abscess is deprived of its nourishment by such dissections and necroses

When the subperiosteal abscesses occur on the anterior aspect of the sternum they have little or no clinical importance. Those occurring on the posterior aspect are important factors in the production of complications peculiar to osteomyelitis of the sternum because of its anatomical position these complications form determining factors in the extraordinary mortality accompanying acute osteomyelitis of the breast bone

The chief of these complications are mediastinal, intrapleural and intra-pericardial suppurations. Some of these are due to frank perforations of a retrosternal subperiosteal abscess, others are sympathetic processes called forth by the presence of infectious processes in the sternum and its periosteum and are produced by bacterial progression through the lymphatics either into the lymphatic network of the mediastinum or into the lymphatic spaces of the pleural and pericardial sacs. Both varieties are usually accompanied by the clinical signs of a profound infection and are frequently unrecognized either before operation or before their post-mortem demonstration. Except in those cases in which the osteomyelitic foci in the sternum are accompanied by states of bacteræmia or general blood infection, practically the entire mortality is due to these complications within the interior of the thorax

In the second variety the focus of infection develops in the cancellous substance of the sternum. A peculiar form of creeping, molecular destruction of the bony texture results which is very difficult to control except by resection of the sternum in healthy tissue. The physical basis for this advancing process was referred to in another communication, this consists in a continual progression of the thrombus-embolus formation in the focus of infection in the cancellous tissue of the sternum because of the extension of the area of venous thrombosis, from the facts at hand and previously referred to this seems to be due to the unchecked bacterial growth in the clotted area

STATISTICS

Age—The ages of the patients included in this report are the following

4 weeks old	1 case	22 years old	2 cases
9 years old	1 case	24 years old	2 cases
15 years old	1 case	26 years old	2 cases
16 years old	1 case	30 years old	2 cases
17 years old	1 case	35 years old	1 case
18 years old	4 cases	41 years old	1 case
21 years old	3 cases	(Age not noted in one case)	

Two-thirds of the cases occurred in patients between the fifteenth and twenty-sixth years. This must have some relation to the period of time in which the various ossification centres are at their maximum activity. Coincident with the full ossification of the sternum and thereafter, the number of cases of osteomyelitis of the sternum decrease rapidly

Sex—There were eighteen male patients in this series as opposed to six females. The sex is not noted in one reported case

Position of Focus—The distribution of the osteomyelitic process in the sternum was as follows: Manubrium, six times, gladiolus, thirteen times, ensiform process, two times, synchondroses, two times.

In a number of the cases more than one segment of the sternum was involved in the focus of infection. In one case all these segments were involved. The much more frequent involvement of the gladiolus is most probably related to the anatomical peculiarities of the local vascular network and to the arrangement of the various centres of ossification.

Complications—The most important phenomena of osteomyelitis of the sternum are formed by the characters and numbers of the complicating lesions which are met during the course of the illness. As indicated previously, some of these are due to the anatomical position of the sternum and to the fact that the organs, tissues or spaces in which these complicating foci of infection develop are in direct anatomical relationship with the sternum. The others, in spite of their close anatomical relationship to the sternum, are, undoubtedly, metastatic (subsidiary, secondary) foci of infection in the true sense of the word as previously defined.

In this series of cases the following were the complications which were encountered:

Pneumonia	10 cases	7 died
Pleurisy and pulmonary congestion	1 case	1 died
Pulmonary abscess	3 cases	3 died
Pulmonary and renal infarct	1 case	1 died
Retrosternal abscess	2 cases	
Anterior mediastinitis	10 cases	4 died
Pericarditis	2 cases	1 died
Chondro-sternal involvement	1 case	1 died
Sterno-clavicular joint involvement	3 cases	2 died
Peritonitis	1 case	1 died
Liver abscess	2 cases	2 died
Renal abscess	1 case	1 died
Splenic abscess	1 case	1 died
Prostatic abscess	1 case	

In many of the cases these complicating lesions did not exist as isolated foci but existed in combination with other foci. Under these circumstances, the fatalities which occurred could not be directly imputed to any one of the lesions, but, rather, to a state of infection in which the entire organism partook, and in which the demonstrable foci were, perhaps, incidental factors and could be regarded as expressions of the general infection.

Retrosternal Abscess and Anterior Mediastinitis—Retrosternal abscess and anterior mediastinitis formed the most common complication encountered. It was difficult sometimes to make the distinction between retrosternal abscess and anterior mediastinitis from the published records of the cases and in some of them, at least, the distinction would disappear in that the inflammatory area could be classified under either or both of these terms. Four of the ten cases classified as anterior mediastinitis died. Some of these were recognized only at the post-mortem examination, and it is possible, had

efficient drainage been instituted at an early period of the disease, that the fatality would have been averted. As indicated previously in this report, both retrosternal abscess and anterior mediastinitis find their origins in the formation of a subperiosteal abscess on the posterior surface of the sternum.

Pneumonia—Pneumonia formed the next most important complication of osteomyelitis of the sternum. The lesion described is that of a frank consolidation. It is a debatable point whether this lesion was metastatic to the sternal focus of infection, whether it was brought about by a relative immobility of the chest owing to the presence of a focus of infection in the sternum, or whether both of these contributed equally to the pulmonary consolidations. It seems difficult to make an adequate distinction. Pneumonia is apparently a very grave complication, in this series two-thirds of the patients with this complication died.

Pleurisy and Pulmonary Congestion—The two cases of pleurisy and pulmonary congestion most probably belong with the cases of pneumonia. Both of the patients with this complication died.

Pericarditis—There were three cases of pericarditis, two of these died. One of the latter was evidently a case of general infection in which the pericarditis was only one of a number of lesions. In the other, there were coincident mediastinitis and pericarditis and the assumption seems justified that the pericarditis occurred by direct extension of the inflammatory area.

These are the more important complications. All of the others listed in the classification are due to the presence of a general infection in which they form metastatic or subsidiary foci. In one of the cases with liver abscess the umbilical vein was found to contain purulent material.

Differential Diagnosis—The differential diagnosis of osteomyelitis of the sternum is apparently sometimes difficult. The differentiation between osteomyelitis of the sternum and that of the adjacent cartilages or ribs can, on occasion, be an academic one, fortunately in actual practice this is not of much importance. The diagnosis of pneumonia has been made a number of times and the presence of the sternal focus was not recognized until comparatively late, or only at the time of the post-mortem examination. The difficulty can be quite well understood in the extraordinary frequency with which the two conditions coexist. Other conditions—an eroding aneurism, a tumor of the sternum, tuberculosis or syphilis—are conditions to be thought of, these, however, should be easily excluded.

An interesting condition has been described by Ruediger and later by Narat, which the latter calls "xiphoiditis." This should not be confused with true osteomyelitis of the sternum. Xiphoiditis is not an osteomyelitis but, apparently, an isolated perichondritis of the ensiform process, giving rise to tenderness and pain over the xiphoid and to pain in the epigastrium. Narat removed the xiphoid in five cases and microscopic examination showed evidence of chronic periostitis. The pain disappeared spontaneously in some cases, in others it disappeared after the exhibition of salicylates.

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THE SURGERY OF GASTRIC AND DUODENAL ULCERS

EXPERIENCES OF THE FIRST SURGICAL CLINIC UNIVERSITY OF BUDAPEST
(DIRECTOR PROF T DE VEREBELY)

BY GEZA DE TAKATS, M D
OF CHICAGO, ILL

FORMER ASSOCIATE IN SURGERY, UNIVERSITY OF BUDAPEST

ONE of the questions that interests all medical circles to-day, is the treatment of gastric and duodenal ulcers. Purely medical treatment on the one side, conservative or radical surgery on the other, are constantly discussed subjects. All agree on certain absolute indications of surgical interference, such as mechanical obstruction of the pylorus, acute hemorrhage, and perforation. A divergence of opinion is present, however, in the management of chronic callous ulcers. Putting the stomach at rest and controlling the acidity are the objects of medical treatment. Doctor Sippy's important work has shown how many ulcers can be healed this way. Protein-therapy has also given promising results in the hands of some investigators. If no absolute indication exists, we give our patients a medical management for six weeks. If symptoms persist or if symptoms recur after returning to ordinary life, operation is indicated.

There has been much said and written in the last few years about the surgical treatment of gastric and duodenal ulcers, and the work of Haberer, Finsterer, Kelling, A. A. Beig and Alfred Strauss in favor of the radical procedure against other statistics and especially those of the Mayo Clinic for the more conservative treatment are well known. To these I desire to add an experience based on the material of the first surgical clinic of the University of Budapest, from the year 1914 to 1924. (Table I.) These

TABLE I

Gastric Operations of the First Surgical Clinic, University of Budapest 1914-1924

Ulcers gastric and duodenal	841
Carcinomas	401
Sarcoma	1
Fibromyoma	2
Total	1245

Gastrostomies, furthermore, operations for perforations and hemorrhage are not included in this series.

statistics include 1245 gastric operations for ulcer and carcinoma. gastrostomies and operations for perforated ulcer and for acute hemorrhage are not included in this series. Of the 841 ulcer cases 676 could be traced after the operation and followed up. Table II needs some detailed explanation. The late results were divided into three groups, good, fair and poor,

TABLE II
676 Operations for Ulcers

Operation	Number of cases	Mortality	Good	Late results Fair	Poor
Pyloric exclusion, v Eiselsberg	85	3 5%	60%	10%	30%
Excision, cuneiform, longitudinal and sleeve resection	41	3 7%	65%	15%	20%
Gastro-entero-anastomosis	274	5 8%	50%	22%	28%
Radical resection *	226	5 4%	84%	10%	6%
Secondary resection for recurrence	20	7 3%	81%	14%	5%
For jejunal ulcers	21				
First 200 anastomoses mortality				2 7%	
Last 74 anastomoses mortality				7 7%	
Last 88 resections mortality				3 3%	

* A distinction should be made between gastric and duodenal ulcers. Gastrectomy for the former is more generally accepted. However in order to gain a true basis of comparison for the merits of gastrectomy *versus* gastro-enterostomy, a uniformly radical indication has been adopted.

good meaning no complaints, fair occasional complaints and poor recurring of symptoms. As you see, the pyloric exclusion gave us 30 per cent poor results, and in accordance with other data in the literature, this procedure predisposes the most to jejunal ulcers. We have abandoned this method completely.

The various types of excision whether cuneiform, longitudinal or circular have been abandoned because late results have not been satisfactory. We have not tried the Balfour cautery method plus anastomosis.

The unusually high mortality of anastomosis is due to the following fact. The first 200 operations were performed on all risks with a typical retrocolic posterior short loop, 27 per cent was the mortality. In the last 74 cases the mortality was high (74 per cent) because the anastomosis was only performed when resection was not possible, either because of anatomical conditions or because of the general bad state of the patient. On the other hand, the mortality of radical resections (54 per cent) has been reduced to 33 per cent by growing experience and perfection in technic in the last 88 cases. This percentage is only 06 per cent higher than that of the routine anastomosis. Adding furthermore the great mortality of re-operations to that of the anastomosis, we find that the risk for the patient is by no means greater in gastrectomy.

Another observation which is in favor of radical procedures is the following. In examining histologically our resected gastric ulcers, in 25 per cent atypical proliferations were found on the margin of typical callous ulcers. Macroscopically no expert pathologist can detect a beginning carcinoma developing on the basis of an ulcer.

No one can give an exact explanation for the good functional results after radical resections. The change in innervation and the lowering of acidity may be made responsible for the favorable functional results. In Table III

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TABLE III

Lowering of Acidity

Number of cases	Type of operation	Before operation	After operation
200	Anastomosis	F HCl, 24 T A, 53	F HCl, 23 T A, 46
200	Resection	F HCl, 30 T A, 56	F HCl, 3 T A, 15

the lowering of acidity was determined in 200 anastomoses and the same amount of resections three weeks after the operation. It seems evident that technically well-performed resections practically do away with free hydrochloric acid. No pernicious anaemia or any other intestinal disturbance was noted. Time will show how these patients without pylorus, antium and hydrochloric acid are going to fare in life.

Our always lessening mortality which decreased to 3.3 per cent in the last 88 cases may be due to three factors:

1 *The Use of Local Anaesthesia*—Every resection is started under local. After opening up the abdomen splanchnic anaesthesia is performed. In 85 per cent of the cases no pain was felt during operation. In 15 per cent ether by the drop method had to be added, however the quantity never exceeded 25 to 50 c.c., a very small dose in comparison with the long duration of the operation. In a good abdominal wall-block, the muscles are well relaxed and the general anaesthetic is only given for the intra-abdominal pain.

2 *The Use of an Intestinal Sewing Machine* (Fig. 1)* Both duodenal and gastric stumps are sewed with powerful crushing clamps that bury new silver clips in four rows and perform an aseptic and watertight closure in two to three minutes. A continuous row of serous sutures is made to bury these metal clip sutures. This procedure is not only absolutely aseptic but shortens the duration of the operation considerably. It is also as safe as any other suture and having used it for the last ten years in all our intestinal cases, we found no reason to suspect any failures due to this apparatus.

3 *The Third Factor* for the improvement in results is the constantly growing experience of our staff in this type of operation. It may seem superfluous to emphasize this fact, but there is a tendency in this country and elsewhere to look down upon technic as something of secondary importance. A good theoretical basis is extremely important for the surgeon. At the

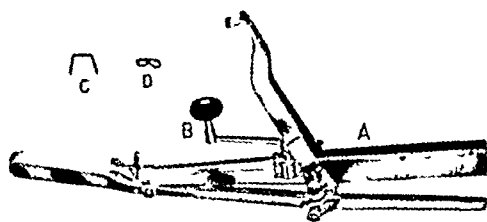


FIG. 1—Hult's wire-stitching instrument. A represents the broad, square crushing clamp which harbors the four rows of staples C, B, shows crank, by turning the same to the right, after the clamp has been closed, the staples are driven through the tissues (wall of stomach or intestines) and their ends bent inward (D), having met the resistance of the other branch of the clamp beneath. The bent staples are gradually pushed off in the course of the healing and discharged through the rectum. They do no harm.

* Described in this country in Ochsner's II volume of *Surgery* in an article of Dr. Willy Meyer. The above illustration is taken from that article.

University of Budapest nobody is admitted to the surgical staff so long as he has not had at least one year's work in the pathological institute. Yet let us not forget that all other factors being the same, a good and swift technic may mean the life of the patient. This is especially true in gastric surgery.

There is some modification in the technic employed in our gastrectomies (Fig 2). The duodenum is closed blindly and so is the stomach in an extent to remove about two-thirds of the stomach. Instead of suturing a loop of jejunum in its whole length into the gastric stump like Polya does or closing the upper two-thirds like Finsterer, we close the whole stomach, amputate the resulting blind pouch at the lower end of the stump and suture a not too short loop transversally into the opening. The proximal loop is fixed with a few interrupted sutures to the blind end of the stomach so as to avoid regurgitation. This method has been devised because in Finsterer's technic, a blind pouch appeared soon after the operation under the X-ray, opposite the cardinal

opening and caused sometimes distress to the patient. In our technic, the anastomosis lies on the left side of the spinal column, the efferent loop being in a straight line with the œsophagus.

Discussion —

It may seem a paradox, but our radical procedure does nothing more, but carry out

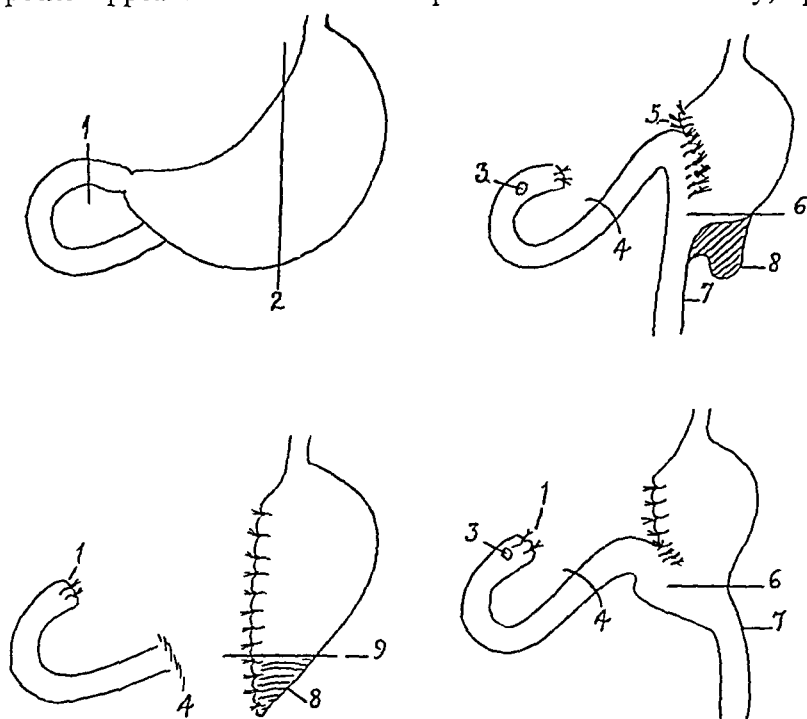


FIG. 2.—1 Section through duodenum 2 Section through stomach 3 Papilla of Vater 4 Plica duodenojejunalis 5 Sutured part of gastric stump 6 Anastomosis 7 Efferent loop 8 Blind pouch 9 Line of amputation

the principles of medical treatment. We have said that medical treatment aims rest and neutralization. A gastric resection achieves the same. It surely relieves all spasms and lowers the acidity considerably.

Gastrectomy has been called mutilating, destructive. It really only creates simpler conditions. Gastrojejunostomy is surgically a smaller interference but upsets the normal function of the stomach considerably. One of two things can happen. Either the ulcer heals, the pylorus opens and we have two openings, a vicious circle and a constant filling of the proximal loop, the same diseased state appears as in an unnecessary anastomosis, or the pylorus is closed completely by scar tissue, all gastric contents move through the

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anastomosis The regurgitation of the duodenal contents is not possible through the pylorus the neutralization is faulty and the chances of a jejunal ulcer are great Mann's extensive studies on experimental ulcers speak very much for this point In diverting the secretions which neutralize gastric juice to a farther point, he obtained typical chronic peptic ulcers in a high percentage of cases Between these two extremes lies the bulk of cases with no complete relief of spasms with no lowering of acidity and with a mechanism to which nature has adapted itself, but which may be upset very easily In the present time when one is apt to think more of function than of anatomical integrity, gastrectomy does not seem to be much more destructive than an anastomosis

The difference between these statistics and those published in this country is striking, especially in the case of gastro-enterostomy Our charity material, coming late for operation and unable to observe a post-operative diet may be partly responsible for the great number of recurrences and jejunal ulcers Gastrectomy then is also a social indication

Gastric surgery is still in its evolution We seem to have swung back to the time of Billroth, who in 1881 first advised a radical resection A combined effort of the internist and surgeon might bring a further lowering in mortality At the present time, on the basis of the statistics above, in case of unsuccessful medical treatment a radical procedure for gastric and duodenal ulcers seems advisable

A STUDY OF 6797 SURGICALLY REMOVED APPENDICES

BY SHIELDS WARREN, M D

AND

ALICE S WARREN

OF BOSTON, MASS

FROM THE PATHOLOGICAL LABORATORY, OF THE BOSTON CITY HOSPITAL

SINCE January 1, 1914, 6797 appendices have been examined at the Pathological Laboratory of the Boston City Hospital. Most of them were received from the operating rooms of the hospital, a number from the Carney Hospital, and the remainder from surgeons in private practice. By far the commonest cause of removal of the organ was a diagnosis of appendicitis, though routine removal in abdominal operations for other conditions, particularly gynecological, provided a large number. The practice of removing "interval appendices" has considerably raised the proportion of those diagnosed as "healed." Owing to lack of clinical data no attempt has been made to group the cases according to pre-operative diagnosis.

This study was undertaken to check the value of the criteria used for diagnosis of the various pathological types of appendicitis, and to determine the incidence of some of the rarer lesions.

The same method of examination of the appendices has been followed throughout with but few exceptions. The gross appearance of the organ is noted when received, and the unopened appendix is fixed *in toto* in alcohol-formalin. Occasionally portions which appear of unusual interest are fixed in Zenker's fluid. After fixation four pieces (for the past year three only) are cut from the appendix—one 0.5 cm. from the tip, one near the proximal end, and the others at any points of apparent interest. After imbedding in celloidin, sections are cut and stained with hæmatoxylin-eosin. In this way there is little likelihood of missing any pathological process.

The sections are examined by the assistants and internes in the pathological laboratory, and their diagnoses are checked by the pathologist. In the present study some of the slides diagnosed as acute and as healed appendicitis have not been reexamined. In only very rare instances does the diagnosis recorded in this report differ from the original diagnosis.

The two essentials for the diagnosis of acute appendicitis are the presence of pus in the lumen of the appendix and some evidence, even though slight, of inflammation in the wall. No attempt has been made to subdivide acute appendicitis into gangrenous, phlegmonous or ulcerating types owing to the artificial character of such a classification. One portion of a given appendix may serve as a text-book illustration of phlegmonous appendicitis, while nearby the process is frankly ulcerative. Moreover, perforation is not a prerequisite of peritonitis.

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The study of these acute cases has further strengthened the views of the writer¹ that acute appendicitis is enterogenous in origin and that no one specific organism causes the lesion. Oxyuris was an incidental finding in three cases only of acute appendicitis, less than 0.15 per cent of the total cases of acute appendicitis.

The number of acutely inflamed appendices was 1849, or 27.20 per cent of the total.

The border line between acute appendicitis and healing appendicitis on the one hand and healing and healed on the other is not easily determined. The point when the eosinophiles in the wall of the appendix outnumber the neutrophils and the fibroblasts show evidence of proliferation has been arbitrarily chosen for the first. When less than six eosinophiles are present in the muscularis of a single section, the lesion is considered as healed rather than healing. The lesions which show only a few eosinophiles have been called late healing. Eight hundred and eighty-one, or 11.49 per cent, were diagnosed as healing. Of these, 98 were noted as late healing. The lumen of the healing appendix may be obliterated for a portion or all of its length, if the former, the condition is known as healing appendicitis with partial obliteration, of which seven instances were encountered, if the latter, healing appendicitis with complete obliteration, of which we found 30. In 28 cases the healing appendicitis is complicated by a periappendiceal abscess.

By far the largest group is that of healed appendicitis. The great bulk of cases diagnosed clinically as "chronic appendicitis" fall in this classification. The criteria are simple—collections of lymphocytes either in lymphatics or in the tissues of the muscularis or serosa. There may or may not be definite evidence of scar formation in the wall. Often the amount of fat in the submucosa appears much increased though this is not a constant finding. Under this heading 2445, or 35.97 per cent, are included. The amount of glandular epithelium remaining viable after subsidence of the inflammatory process determines the extent to which the lumen remains patent. A portion of the lumen is obliterated in 95 healed appendices, and all the lumen in 336. Two of the appendices with completely obliterated lumina contain foci of calcification, which in one has progressed to true bone formation.

The terms applied to the various types of recurrent appendicitis are self-explanatory, and the number of cases of the various types are given in Table I.

We believe that the term periappendicitis should be restricted to those cases in which the submucosa and mucosa are not involved in the lesion and in which the source of infection is the peritoneal cavity. Hence, with the exception of tuberculous periappendicitis, we do not make a diagnosis of periappendicitis in males. The presence of granulation tissue and a predominance of eosinophiles or lymphocytes in the exudate mark the transition of the lesion from the acute to the chronic stage. In our series are 61 cases of acute periappendicitis, 8 additional cases complicated by periappendiceal abscess, and 238 cases of chronic periappendicitis.

In the appendix the lesions of tuberculosis resemble those produced in

other organs We encountered tuberculous periappendicitis 15 times and tuberculous appendicitis 30 Two additional appendices show healed lesions of tuberculosis in the muscularis

Typhoid fever also is readily recognizable, the lesion differing but little

TABLE I
Incidence of Appendiceal Lesions

Diagnosis	No. of cases	Per cent. of total
Acute appendicitis	1849	27.20
Healing appendicitis	881	11.49
Healing appendicitis with partial obliteration	7	00.11
Healing appendicitis with complete obliteration	30	00.44
Healing appendicitis with periappendiceal abscess	28	00.41
Healed appendicitis	2445	35.97
Healed appendicitis with recurrent acute appendicitis	42	00.62
Healed appendicitis with recurrent acute appendicitis and partial obliteration	7	00.11
Healed appendicitis with recurrent healing appendicitis	7	00.11
Healed appendicitis with recurrent healing appendicitis and partial obliteration	7	00.11
Healed appendicitis with recurrent healing appendicitis and complete obliteration	4	00.06
Healed appendicitis with partial obliteration of lumen	95	01.40
Healed appendicitis with complete obliteration of lumen	336	04.94
Acute periappendicitis	61	00.90
Acute periappendicitis with periappendiceal abscess	8	00.12
Chronic periappendicitis	238	03.50
Typhoid appendicitis	1	00.01
Tuberculous appendicitis	30	00.44
Healed tuberculous appendicitis	2	00.03
Tuberculous periappendicitis	15	00.22
Oxyuris and acute appendicitis	3	00.04
Oxyuris and healing appendicitis	4	00.06
Oxyuris and chronic appendicitis	1	00.01
Oxyuris and healed appendicitis	43	00.63
Oxyuris in negative appendix	5	00.07
Tenia in negative appendix	1	00.01
Mucocele	5	00.07
Carcinoid	26	00.38
Neuroma	1	00.01
Malignant adenoma	3	00.04
Cystoid carcinoma	2	00.03
Cancerous periappendicitis	1	00.01
Lymphoblastoma	2	00.03
Negative	607	08.97
	6797	

from the one typically found in the intestinal lymphoid tissue Only one instance of typhoid appendicitis was found

The appendices containing oxyuris we have grouped together in Table I merely for convenience We do not feel that the worm has more than a

A STUDY OF SURGICALLY REMOVED APPENDICES

passive relationship to the pathological processes except in one case, which we have diagnosed as chronic appendicitis due to oxyuris. The mucosa and submucosa as well as a regional lymph-node are definitely the seat of chronic inflammatory process, and the lumen was packed with the oxyuris.

One appendix, otherwise, negative, contained several segments of a *Tenia*.

In 607 appendices 8.97 per cent, no pathology is demonstrable. Not all of these were removed in the course of an operation for some other condition.

A certain number of pathological curiosities have also been observed. Among these may be mentioned 5 cases of mucocele. During the same period of time 2 cases, one of the "globoid body" type, were encountered in autopsy material.

One appendix shows a piling-up of nerve and connective tissue in the scar of a healed appendicitis comparable to an amputation neuroma.

The tumors in this series are of considerable interest. The commonest is the so-called carcinoid, of which we have 26 cases, 0.38 per cent. In Table II is shown their distribution by sex and by condition of the appendix. A decided preponderance of these tumors in women is indicated.

TABLE II
Occurrence of Carcinoids

	Male	Female	Unknown
Acute appendicitis	1	3	
Healed appendicitis	2	16	4
	—	—	—
Total	3	19	4

Of three cases of malignant adenoma, two are primary in the appendix. The other involves the appendix by extension from the primary focus in the cæcum. Both the cases of colloid carcinoma were primary in the appendix.

One appendix diagnosed as cancerous periappendicitis was removed from a case of carcinoma peritonei.

Two cases of lymphoblastoma involve the appendix by extension from the cæcum.

Discussion—Very rarely appendices are encountered which contain pus in the lumen, but show no evidence of inflammation in the wall, either in gross or in the sections taken for microscopic study. These we have classified as acute appendicitis, but perhaps they might be better diagnosed as chronic appendicitis, in as much as the inflammatory process is very mild and the clinical history suggests a long course.

As regards recurrent appendicitis, it is worthy of note that it is of relative rarity, and that acute recurrent appendicitis did not occur in any of the appendices with completely obliterated lumina. Healing recurrent appendicitis was present in four appendices with complete obliteration of the lumen, but here the obliteration might well be a result of the healing process. We believe that an appendix with completely obliterated lumen cannot become inflamed, except as a periappendicitis.

One lesion which does appear to be more frequent in healed appendicitis than in negative or acutely inflamed appendices is the carcinoid. As can be seen from Table II, 22 out of the 26 cases occurred in appendices showing evidence of past inflammation. We believe that this throws some light on the etiology of the lesion. It seems not impossible that during the healing of an acute appendicitis some of the cells at the bases of the crypts of Lieberkuhn, argentaffine or otherwise, should become isolated in connective tissue or even muscle fibres and multiply in this location. In chronic salpingitis somewhat analogous epithelial masses may be occasionally encountered far out in the muscularis. Jackson² believes that chronic appendicitis may be an important factor.

Our percentage of carcinoid (0.38) is practically that found by McWilliams³ in his large series. The marked predominance of females in our cases is noteworthy.

The number of appendices in which oxyurias was encountered is strikingly low. This, however, is obviously due to the method of examination. The presence of oxyurias would not be noticed unless one or more worms happened to be in the regions sectioned. In only one case did the parasites seem to have any relation to the inflammatory process—the one given in the table as oxyuris and chronic appendicitis. This case would seem to fulfill Brauch's⁴ criteria for appendicopathia oxyurica.

SUMMARY AND CONCLUSIONS

1. Criteria for the pathological diagnosis of the various types of appendicitis are offered, based on 6797 surgically removed appendices.

2. The diagnosis of chronic appendicitis is rarely justified pathologically, and should be reserved for those cases in which pus is present in the lumen without evidence of inflammation in the wall.

3. Benign tumors of the appendix, the so-called carcinoids, may be of inflammatory origin. They occur far more frequently in females than in males in this series. These 26 cases of carcinoid have not been previously put on record.

4. Oxyuris is rarely the cause of pathological change in the appendix.

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PYELOGRAPHY IN RENAL DIAGNOSIS*

BY LEON HERMAN, M D

OF PHILADELPHIA, PA

RENAL studies have become so perfected that the later lesions alone excite unusual interest. Of the various procedures employed, pyelography has shown probably the greatest development not only in technical perfection, but also in permitting a practical pictorial classification of pelvic deformities into groups more or less characteristic of the underlying pathology. In attempting to interpret pyelograms that present deviations far removed from the familiar standards in abnormality of pelvic outline one is handicapped merely by inexperience. For this reason there is greater educational value in the study of the extremely bizarre in pelvic outline than in large collections showing only slight variations from the well-known standards. A wide familiarity with pelvic deformities due either to congenital anomalies or surgical diseases aids materially in the proper evaluation of data obtained by renal functional studies, clinical symptoms and physical signs. A description therefore, of some unusual pyelograms together with certain clinical and technical considerations will not be without practical value.

Technical Considerations—

Technical perfection in pyelography implies equal appreciation on the part of the urologist and roentgenologist of its diagnostic value. This is especially true when the data is obtained largely from fluoroscopic observations of the injected pelvis. The examination must be conducted by one familiar not only with roentgenology, but also with pyelographic technic and the wide range of pelvic deformities which it reveals.

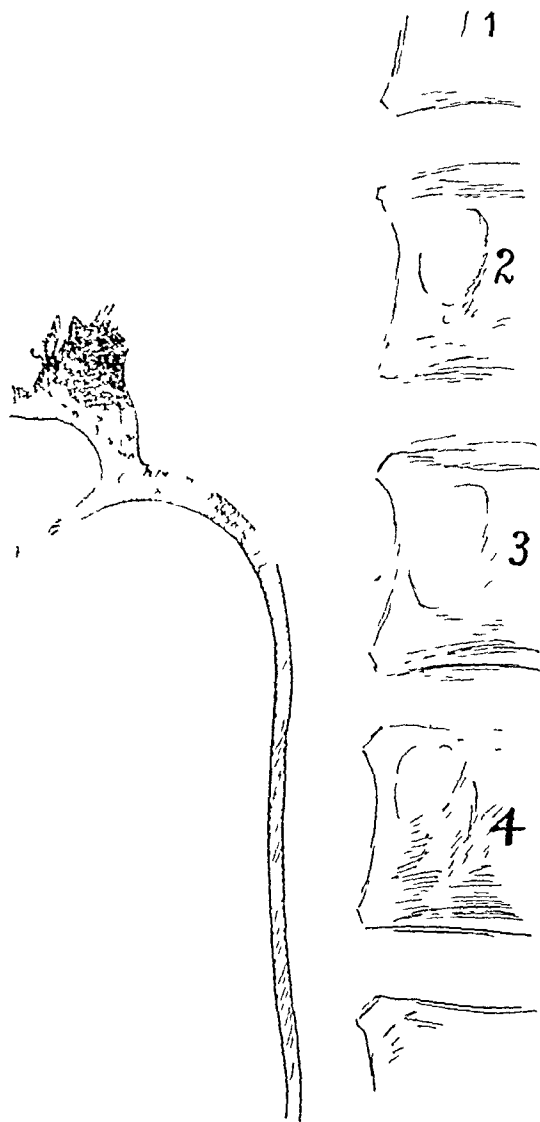


FIG. 1—Outline of the pyelographic shadow in a case of infected polycystic kidney. The pelvic deformity is suggestive of that caused by hypernephroma.

* Read before the Philadelphia Academy of Surgery, November 2, 1925

We reserve the fluoroscopic method for use in cases in which it is desirable to observe the range of mobility of the injected pelvis. Thus in the diagnosis of movable kidney and in the differentiation of the renal from the extra-renal mass, this method has the advantage that in cases of extra-renal tumors situated in the renal area, the tumor may perhaps be moved bimanually under vision without dislocating the shadow of the injected pelvis. This rather limited use of the method results from our experience that for other purposes,

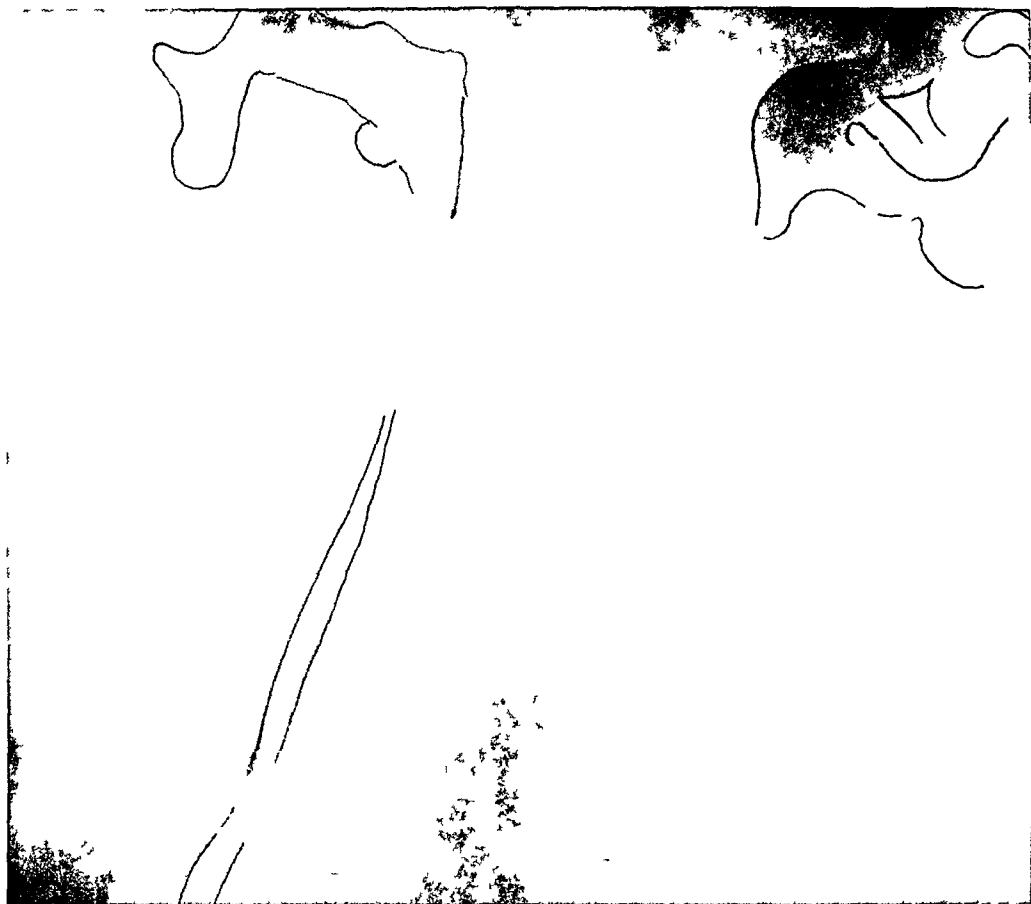


FIG 2 —Pyelogram in a case of bilateral polycystic kidney. Note the extreme irregularity of the pelvic shadow due in part to pressure of the cysts on the pelvis and in part to rupture of the cysts into the pelvis.

stereoscopic Bucky diaphragm plates are easier to interpret, and yield more valuable data, and with greater certainty.

The fallability of both the fluoroscopic and plate methods is well illustrated in a case in which we were convinced that a large tender mass in the upper right abdomen could be moved from before backward without displacement of the pelvic shadow. Direct inspection of the injected pelvis as well as the plate disclosed, however, marked deformity of the pelvic outline (Fig 1). This evidence not only discredited the clinical diagnosis of infected movable kidney, but indicated likewise, either that the fixation was apparent and not real, or that we were dealing with a renal lesion in association with an extra-renal mass. The pelvic deformity as revealed in the plate indicated not only

the presence of a renal lesion, but was of a type highly suggestive of hypernephroma. This pyelogram is truly bizarre, but it presents a deformity having more in common with the spider leg pyelogram so characteristic of hypernephroma than with any other renal disease or anomaly. Operation disclosed an infected polycystic kidney. This is an instance where the pelvis suffered obliterative changes in outline and assumed a type far removed from that characteristic of polycystic kidney to approach the type very suggestive of hypernephroma. This led us to disregard the very important fact that the



FIG 3 —(See also Fig 4) Pyelogram in a case of caseo-cavernous tuberculosis. The shadow represents a mass of silver iodide solution.

opposite and non-palpable kidney was low in function without obvious cause. In our experience, this is almost pathognomonic of polycystic kidney in the presence of a unilateral renal mass, since in other surgical diseases of the kidney giving rise to unilateral enlargement, the opposite kidney is either increased in function as the result of compensatory hypertrophy, or, if the function is depressed, the cause is more or less obvious (Fig 2). In obscure cases such as the foregoing, bilateral pyelography at different sittings, is strongly indicated.

Before injecting a pyelographic medium, the capacity of the renal pelvis should be measured accurately. This we do routinely by injecting normal saline solution until the pelvic walls are under moderate tension as can easily

be determined by removing the needle from the catheter from time to time and noting the rate of return flow. Having determined the amount of medium necessary to obtain adequate distention of the pelvis, pyelography can be carried out painlessly by the syringe method, and with greater safety than by the gravity method.

Fluids injected into the renal pelvis even under moderate degrees of pressure, may become widely disseminated throughout the renal parenchyma, which fact rationalizes the exclusive use of media for pyelography that are

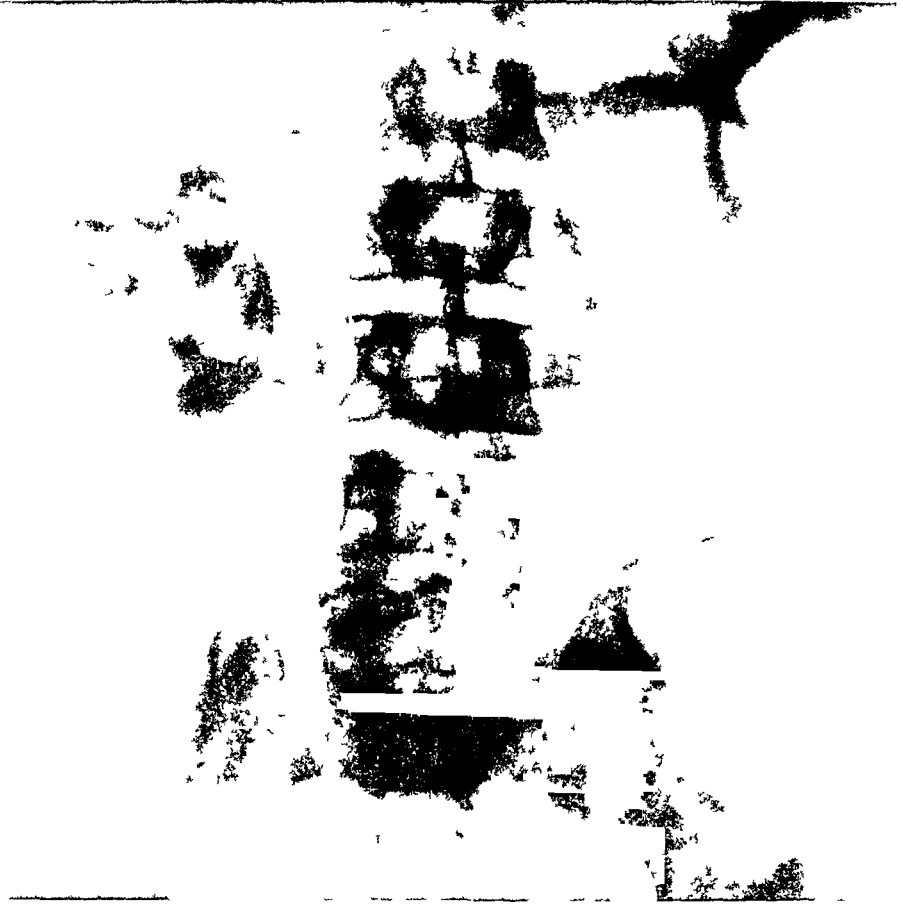


FIG 4—(See also Fig 3) Röntgenogram taken one month after the injection of thirty c c of silver iodide solution. The medium has been retained and has become disseminated throughout the contents of the caseo cavernous tuberculous kidney.

free from particles held in suspension. As long ago as 1916, Braasch and Mann¹ showed that the greatest danger in the use of silver preparations is their retention in actively secreting kidneys, and that silver iodide in solution is less harmful than the colloidal silver preparations. We mention this fact for the reason that silver iodide has again been recommended as a pyelographic medium on the basis of its antiseptic properties.² In marked states of upper urinary stasis, the injected fluid remains for variable periods of time. The irregular shadow in Fig 3 represents a mass of silver iodide solution which was injected into the pelvis of the kidney the seat of advanced caseo-cavernous tuberculosis. Figure 4 is that of a röntgenogram in the same case,

made one month later without further injection, the medium has been retained and has become widely disseminated throughout the contents of the pelvis

It suffices for all practical purposes to assume that the tendency to diffusion of pyelographic media exists, and that the most important contributing cause to such diffusion is increased intra-pelvic pressure. We present a most extraordinary pyelogram (Fig 5) which would seem to indicate that in rare instances a pyelographic medium (one in three thousand mercuric iodide, in twelve per cent sodium iodide solution), when injected into the pelvis of the

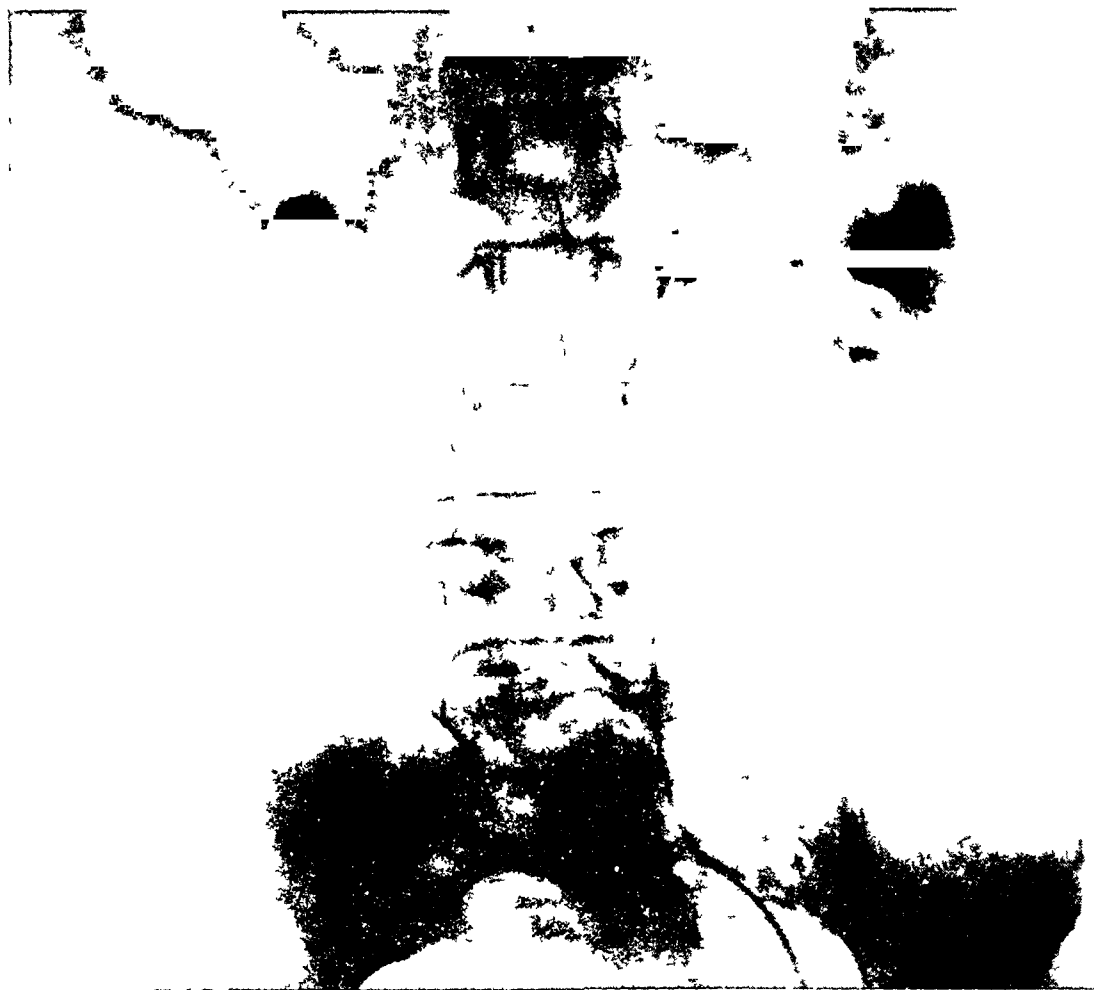


FIG 5 —Pyelogram showing tubular filling. There was an intracortical abscess at the lower pole of the kidney at which point the tubules are not filled

human kidney may enter, and become widely disseminated within, the lumina of the uriniferous tubules in quantities sufficient to outline the tubular system in the roentgenogram. The injected tubules are represented by lines which radiate fan-wise from the minor calyces. This condition was produced by the injection of twenty c c of the sodium iodide solution under somewhat greater pressure than is used ordinarily in the making of a pyelogram. It will be noted that the pyelogram is peculiar only in the fact of tubular filling, the pelvic is normal in outline. The differential functional studied showed very slight diminution in function of the right kidney and the urine was both sterile and pus free. There was the history in the case of a severe injury to the right loin followed by one year of invalidism due to pain in the right

loin space and right upper abdomen. Immediately following the receipt of the accident, hæmaturia was noted and after some months, the patient states that a large quantity of pus was voided. During the patient's residence in the wards of the Pennsylvania Hospital, we noted an irregular course of fever associated with a moderate leucocytosis, and tenderness in the right loin space and over the region of the gall-bladder. Dr Charles Mitchell, in whose service the case occurred, and the writer decided upon exploratory abdominal operation which revealed no abnormality except two nodules which could be

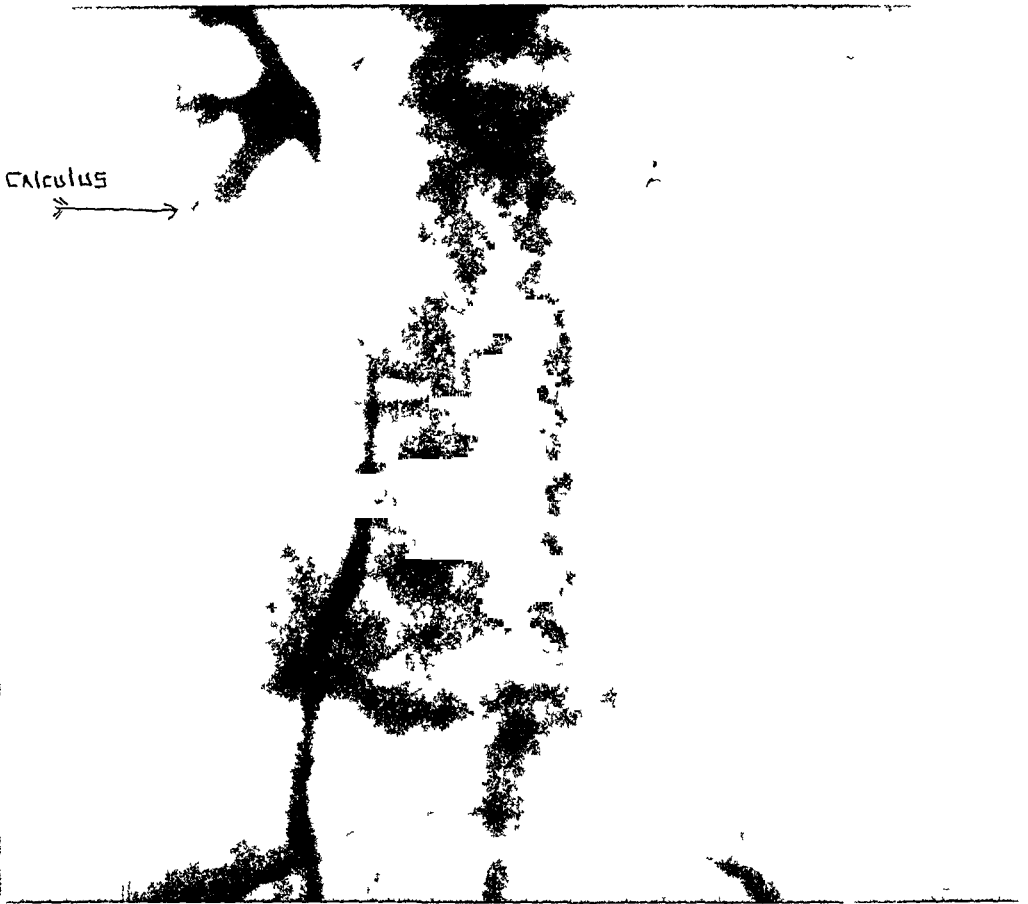


FIG. 6—Pyelogram in the case of a small calculus impacted in the lower posterior calyx. The isthmus was narrowed proximal to the stone.

felt deeply embedded in the substance of the right kidney. These proved to be chronic intracortical abscesses separated from the surrounding grossly normal cortex by thick walls of well-organized scar tissue, there was no evidence of perinephal infection, the capsule being perfectly normal.

The relationship between this rare kidney lesion and the production of tubular filling is an interesting speculation. Owing to the chronicity of the renal abscesses, it is reasonable to assume that the pyelography had no part in their production, although parenchymal extravasation of pyelographic media is prone to occur, and in the presence of infection, it is reasonable to believe that it might produce a cortical lesion. The fact, too, that the pyelographic

study was not followed by the slightest systemic reaction may be taken as rather conclusive evidence that the renal abscesses antedated the injection of the kidney

We report this primarily as one of the very few clinical demonstrations which tend to support the theory, that tubular filling is the means of the intraparenchymal dissemination of fluids injected into the pelvis of the kidney

Hinman and Lee-Brown seek to explain the accidents of pyelography on



FIG 7 —Pyelogram in a case of infected sarcoma of the kidney

the phenomenon of pyelovenous backflow, which implies the direct entrance of fluids injected under pressure into the renal pelvis into the venulæ rectæ at the bases of the pyramids. The condition is due they say "to the fact that the rich plexuses of the venulæ rectæ at the bases of the pyramids are in close apposition with the deep sulci of the minor calyces". Hinman's conclusions are based on experimental studies, and some of the roentgenological evidence presented shows radiating lines of the injected fluid, but with a different distribution than in our case, and for the probable reason that they represent the medium disseminated in structures other than the uriniferous tubules. This writer holds that "pelvic distention would tend to close by compression this system tightly" and that "injection of the deeper renal

tubules is impossible by way of the ureter, and parenchymal extravasation requires pressure probably never produced clinically."

Hinman bases the theory of pyelovenous backflow on the most careful experimental work, but there are reasons for believing that in some instances at least, fluids injected into the pelvis pass into the uriniferous tubules and probably enter the blood vascular system through the glomerular circulation.

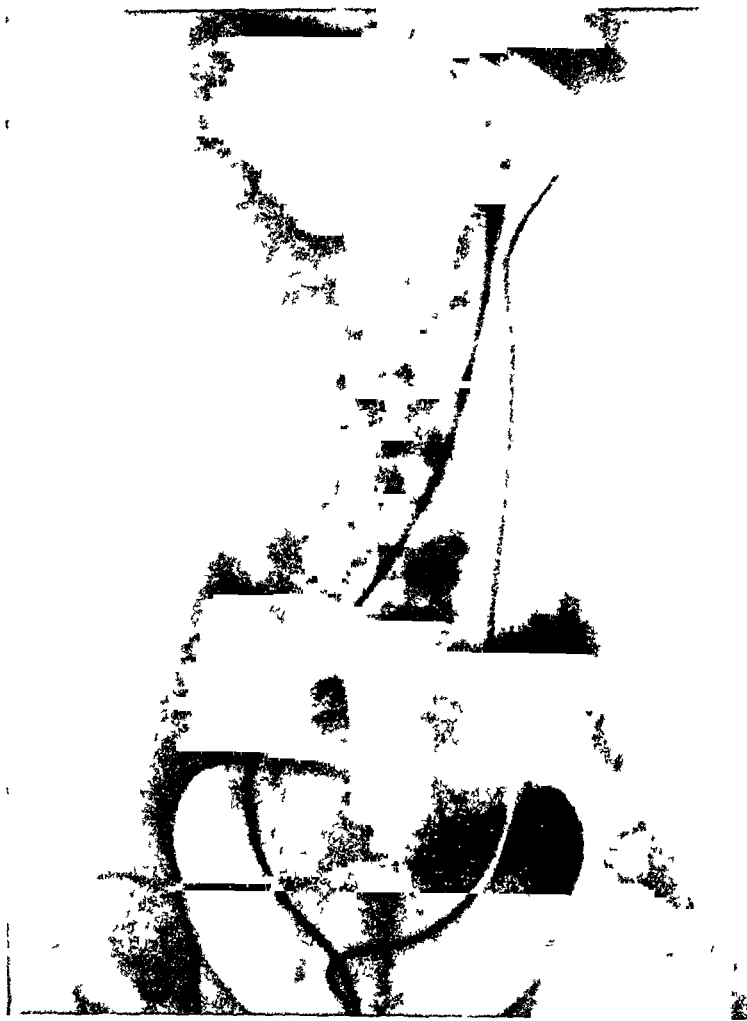


FIG 8.—Pyclogram in a case of enormous solitary serous cyst of the left kidney. Note that the ureter has been displaced across the spinal column, and that the kidney has been pushed upward.

Thus O'Connor⁴ has shown that after pelvic lavage with solutions of silver nitrate the presence of metallic silver can be demonstrated in the most distant collecting tubules, and furthermore, that within twenty minutes after the injection of mercuriochrome the drug had reached the glomeruli by passing directly up the lumina of the tubules, especially at the poles of the kidney where tears in the parenchyma are prone to occur under the circumstance of pelvic overdistention. Mason,⁵ Burns and Schwartz⁶ and

many others submit corroborative evidence but after discussing the opinions of these various observers, Hinman concludes that "all the clinical accidents following pyelography are primarily due to the structural phenomenon of pyelovenous backflow."

The findings in the human case herewith described would seem to indicate that in some few instances, for reasons as yet unknown, a pyelographic medium may be forced into, or enter an already open uriniferous tubular system.

Comparative Diagnostic Value of Pyclography and Renal Functional

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Studies—The routine use of the phenolsulphonephthalein test for differential functional determination has far wider applicability than pyelography in urological diagnosis. With extended use of the latter, however, one becomes dependent upon the data acquired, not alone for diagnosis, but as the means of predetermining surgical problems involved in various diseases of the kidney and upper ureter. This applies especially to the surgery of ureteral kinks, urinary stasis due to congenital or acquired abnormalities in the insertion of the ureter into the renal pelvis, and renal calculi, in which conditions,



FIG. 9.—Pyelogram showing ureteral kink.

pyelographic interpretation enables the operator to anticipate the necessary surgical procedures, and thereby simplify the operative technic. In cases of very small calculi impacted in the minor calyces, it is most desirable to learn pre-operatively if the involved calyx is situated anteriorly or posteriorly, whether the calibre of the isthmus is sufficiently large to permit one to deliver the stone into the true pelvis, and finally if the extra-renal portion of the latter is of sufficient size to perform pyelotomy if necessary. Figure 6 is illustrative of a small calculus impacted in the lower posterior calyx of the right kidney. These plates showed when viewed stereoscopically, that the stone occupied the lower posterior calyx, that the isthmus was somewhat contracted, that the stone was lying in the isthmus at right angles to its long axis, and finally

that the size and position of the pelvis in relation with the margins of the hilum of the kidney justified the belief that pyelotomy could be performed without difficulty. The stone was removed in the manner which the pyelographic study indicated would be the simplest procedure, namely, combined pyelotomy and nephrotomy, pushing the stone through a small nephrotomy wound with a finger in the pelvis. In some instances, pyelography yields information that changes entirely one's conception founded on clinical signs, physical findings and differential functional studies, of a seemingly obvious



FIG 10 —Pyelogram showing ureteral kink

renal lesion. This is well illustrated in the case of a young man who came to the Pennsylvania Hospital complaining of a large tender mass in the upper left abdomen, associated with fever, chills, pyuria, and a high leucocytosis. The functional studies yielded the information that the left kidney was functionless and filled with thick purulent material, the right kidney was normal. It would seem that the diagnosis of pyonephrosis with an acute exacerbation of the infection had been fairly well established. In the absence of pyelographic data (Fig 7), the operation would certainly have been advised in the belief that we were dealing with an uncomplicated infection. This peculiar "salamander like" deformity of the pelvis is clearly indicative

of the pressure effects on the pelvis of an unusual type of neoplasm, which proved to be a large sarcoma

The pyelogram may yield important diagnostic data in renal as well as extra-renal conditions in the entire absence of alterations in renal function, or other evidence deductable from cystoscopic investigations. We report in this connection the pyelographic and cystoscopic data in the case of one of the rarest of renal lesions, namely, single or solitary serous cyst. The patient, a young colored woman was admitted to the Pennsylvania Hospital under the

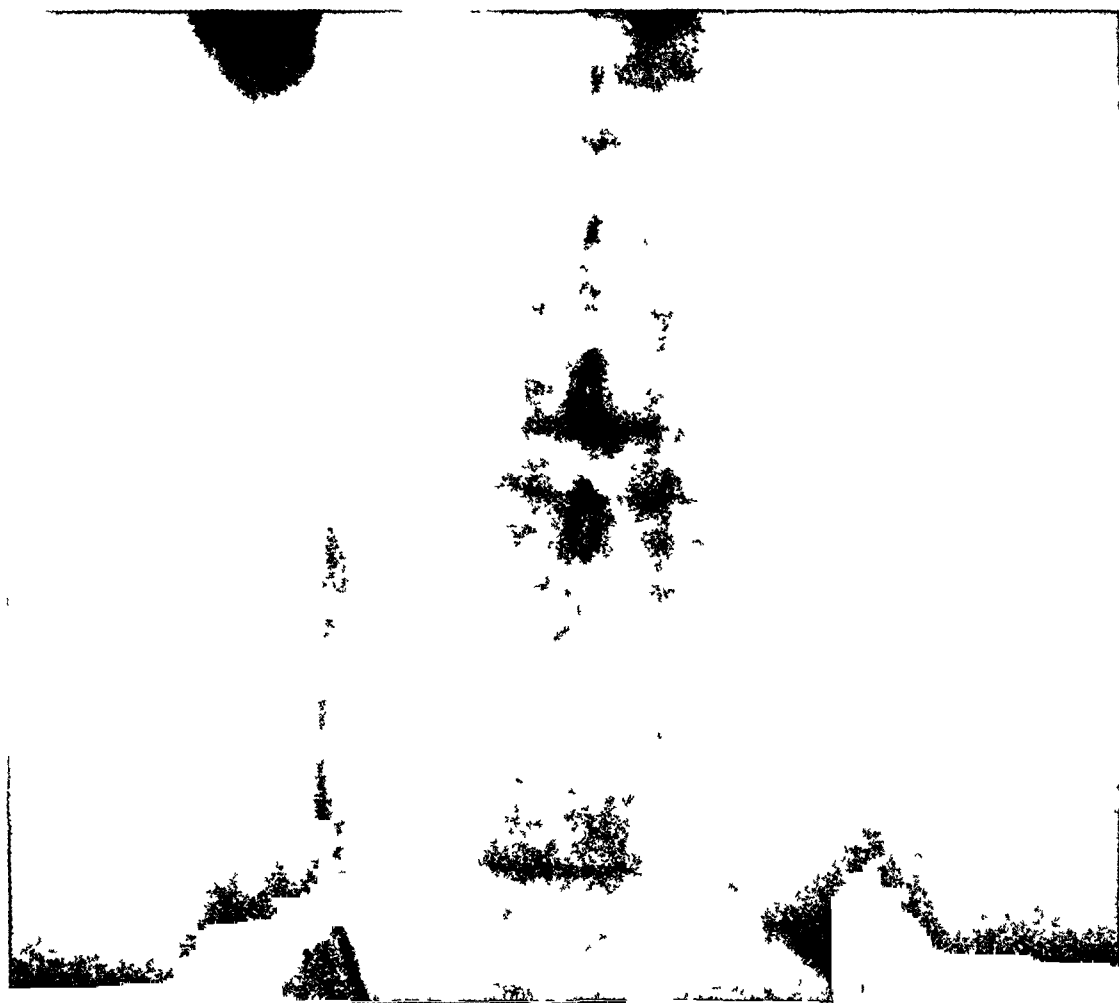


FIG. 11.—Pyelogram showing a filling defect of the true pelvis due to malignant papilloma of the renal pelvis. Note that the lower calyces are obliterated while the upper calyces are dilated.

care of Dr. Edward Klopp complaining of abdominal pain. A large mass was found in the upper left abdomen, the characteristics of which suggested its renal origin, but rather to our surprise the differential functional studies revealed little or no alteration in the elimination of phthalein from either kidney. These findings seemed to justify the opinion that the abdominal tumor was not of renal origin. It will be noted in the pyelogram (Fig. 8) that the left ureter has been displaced far to the right side, that the somewhat dilated pelvis has suffered complete rotation and lies transversely across the body of the first lumbar vertebra having been displaced far upward. With the additional information at hand, it seemed obvious that the lesion could

not be a renal neoplasm of the common type, yet the displacement of the left urinary tract indicated that the mass was retroperitoneal in position, and lying in juxta-position with the kidney. If the mass took origin from the kidney, it was of necessity of capsular origin, otherwise there would have been greater destruction of parenchyma as measured by the functional studies. We finally came to the conclusion that the mass was retroperitoneal in position, and that it had displaced the left kidney upward, all of which was correct but incomplete since the mass proved to be a cyst of the solitary serous type, which is believed to originate from lymphatic spaces in the true renal capsule. In

this as in similar cases, the kidney had become flattened out over the cyst wall but had suffered surprisingly little pressure atrophy.

Another interesting and quite common condition that can be diagnosed only by means of the uretero-pyelogram, is kinking of the ureter, which may give rise to severe renal pain in the entire absence of obstruction sufficient to cause marked dilatation of the pelvis, or back-pressure atrophy of the parenchyma that could be detected by diminution in the percentage output of dye (Figs 9 and 10). Figure 10 illustrates ureteral kinking due to traumatic injury. The patient, a colored man, suffered an injury to the right loin which was followed by hæmaturia and constant upper right abdominal pain. The uretero-pyelogram, which was made with the patient in the recumbent posture, shows a very marked kink of



FIG. 12 — (See also Fig. 11) Malignant papilloma of the renal pelvis

the upper ureter which we assume to be the cause of the patient's invalidism.

Tumors of the renal pelvis present unusual difficulties in diagnosis in the absence of more or less characteristic filling defects of the pelvis as shown in the pyelogram. Even in advanced cases associated with implants in the bladder and marked destruction of the kidney, the diagnosis of pelvic tumor is merely inferential unless the pyelogram reveals partial obliteration of the pelvic lumen. Figure 11 is illustrative of pelvic defection in the case of a malignant papilloma of the left renal pelvis associated with multiple secondary tumors of the bladder. The patient referred for examination by Dr. John Gibbon, complained of profuse symptomless hæmaturia. The routine cystoscopic examination revealed the presence of several small tumors situated at the summit of the bladder and two similar growths in the region of the bladder opening of the left ureter. The differential functional study,

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which showed marked diminution in function of the left kidney, led to pyelographic examination with the results shown in Fig 11. It will be noted that the cavity of the true pelvis and the lower calyces have been obliterated while the upper calyces are dilated, as the result of the presence of a large papilloma (Fig 12.)

Tumors arising from the pelvis at the uretero-pelvic junction or large tumors situated within the cavity of the true pelvis may render pyelography impossible, and one must rest content with the diagnosis of functionless kidney in the absence of secondary implants in the lower ureter or other evidence suggestive of the presence of a primary pelvic neoplasm.

In conclusion, may I be permitted to urge the necessity for complete urological study in obscure abdominal conditions, and especially in those in which upper abdominal pain is the prominent feature, for it is in the study of the unusual case that pyelography is most likely to yield important diagnostic data. Pyelography is not a procedure that can be employed with safety in cases presenting marked dysfunction of the kidneys, neither should it be used routinely in the study of the more or less obvious renal lesions. It is in our opinion a diagnostic measure to be employed supplementary to the routine cystoscopic studies.

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THE ETIOLOGY OF THE POST-OPERATIVE PULMONARY ABSCESS

BY EMILE HOLMAN, M D

OF SAN FRANCISCO, CAL

FROM THE DEPARTMENT OF SURGERY, OF STANFORD UNIVERSITY MEDICAL SCHOOL

PULMONARY suppuration, following operative procedures, is commonly ascribed to the aspiration of infected blood and mucus. Most writers are willing to concede the possibility of a hæmatogenous infection, but are usually quick to add that they believe aspiration to be the most common cause of this unfortunate complication. However, the notable contributions of Fetterolf and Fox¹ have reemphasized the embolic theory, and more recent experimental evidence brings them commanding support².

In attempts to produce a pulmonary abscess in dogs, the smaller bronchi were completely plugged with infected material following scarification of the bronchial wall. Two of the animals died of an empyema, one of a massive pneumonia, and the other eight animals remained well. These negative results correspond closely with the experiences of numerous other investigators³. In marked contrast to these futile efforts, definite abscesses of the lung were produced in fifteen out of twenty-one attempts by introducing into the jugular vein infected emboli, which were held up in the pulmonary circulation. Here these emboli produced septic infarcts, followed by a softening of the pulmonary tissue, with subsequent cavitation and the formation of an abscess. Two of the animals died following perforation of the abscesses into the pleural cavity on the fifth and sixth days, respectively. In the six animals that recovered without the formation of an abscess, subsequent lobectomy revealed healed and healing infarcts.

Closely paralleling the experimental failures to produce an abscess by the introduction of infected material into the bronchi are numerous clinical experiences recorded in the literature. Chevalier Jackson,^{4, 5} in a recent demonstration, presented a large number of most instructive observations. Metallic and organic foreign bodies which had resided in the bronchi for incredibly long periods of time (over thirty years in one instance), with putrefactive processes going on about them, had failed to produce any of the characteristic signs and symptoms of a pulmonary abscess. There was, indeed, considerable increase in density of the tissues around the foreign body, but the entire process had become well circumscribed with none of the evil systemic manifestations of a suppurative pulmonary abscess. Few showed any fever on their admission to the hospital, although some gave a history of an unexplained periodic fever, variously attributed by physicians to tuberculosis, malaria, bronchitis, and even to worms.

Jackson postulates some "unknown factor" which usually, though not invariably, provided a protective barrier to the development of pulmonary abscess in the presence of these foreign bodies in the bronchi, some of which

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were exceedingly foul and obviously infected on extraction. In most cases immediate recovery followed the removal of the offending and offensive intruder.

In contrast to the picture presented by these patients, is that furnished by the unfortunate victim of a pulmonary abscess following some operative procedure. Such an abscess is characterized by a cavity within the lung, filled with foul pus which is expectorated in large quantities, and which makes life an intolerable burden to the sufferer. The presence of such a cavity is usually accompanied also by a toxic absorption which manifests itself by the characteristic systemic reactions of fever, rapid pulse, marked lassitude and weakness, and clubbed fingers.

What are the clinical manifestations that accompany the development of a pulmonary abscess in these latter cases? During the first few days following the operation the patient feels well. Indeed, if tonsillectomy has been performed, he is usually discharged from the hospital before any symptoms appear. It seems unlikely that the aspiration of infected material would be followed by an interim in which the patient is so entirely free of symptoms. Instead of an insidious onset, one would expect an abrupt and progressive development of trouble from the moment the aspiration had occurred. As a rule, however, it is not until the sixth to ninth day that the patient begins to feel ill and "good for nothing." About this time, he may complain of a pain in his side, a high fever may set in, accompanied by chills. Sputum resembling pus may be coughed up, which gradually increases in amount and fetor. Occasionally a history is elicited of a few days of fever, followed by a feeling of something having burst within, accompanied by the immediate ejection of a large amount of pus. A persistent, productive cough follows, but no association with the operation is postulated—the patient has been too well in the immediate interim following the operation to suggest a possible connection. The average period of time between the operation and onset of symptoms in one hundred eighty-seven cases of pulmonary abscess following operations performed under *general* anæsthesia, was six days. Moreover, the average elapse of time between the operation and onset of symptoms in thirty-four abscesses following operations performed under *local* anæsthesia was also six days.⁶

In our experimental animals the first roentgenographic evidence of an abscess was observed to appear about the fourth to sixth day, and to progress to the formation of a definite cavity on about the eighth to tenth day. This close parallelism between the average time of onset of symptoms in the clinical cases and the sequence of events in the experimental production of a pulmonary abscess, is striking and significant, and the inference may be made that the process is dependent in both instances upon the same factor, namely the presence of an infected embolus in the blood stream.

Certain deductions may also be made with reference to the "protective barrier" postulated by Jackson. In the case of an infected foreign body encysted in the bronchus, it may be said that the intruder is outside the

body, as, indeed one may consider food and infected material in the alimentary canal as being outside the body. There is interposed between the foreign substance and the tissues and fluids of the body a protective layer of intact epithelium. The blood supply to the region around the foreign body is not interfered with nor interrupted. The defensive processes of the body can proceed immediately and uninterruptedly to wall off the intruder on all sides. Thus, the foreign body is even more securely than before placed *outside the body*. On the other hand, an infected embolus lodged in the terminal branches of an artery, has broken down the first defense of the organism—the intruder is *within* the body. Such an embolus produces a septic infarct, an area of the lung is deprived of its blood supply, and the organisms which are present in the embolus, having “fallen on good ground,” proceed without interference to multiply “a hundred fold.” Meanwhile, the protective forces of the body are at a distinct disadvantage. Their lines of communication are broken. In the presence of an infective agent the bloodless, ill-nourished pulmonary tissue softens and liquefies, and cavitation follows. It is suggested that an intact undamaged blood supply may be the most important deterrent factor to the formation of a pulmonary abscess following the aspiration of an infected foreign body, and may constitute the protective barrier postulated by Jackson.

An interrupted blood supply may also be an important factor in the post-pneumonic suppurations which constitute the majority of all pulmonary abscesses. One may postulate the following sequence of events, the consolidation of the lobe affected by the pneumonic process may be accompanied by a thrombosis in the smaller vessels precipitated by bacterial toxins. This thrombosis may interrupt the blood supply to a portion of the lung, and in the presence of an infecting agent this devitalized tissue softens and liquefies with subsequent cavitation.

The close parallelism in the failures to produce a pulmonary abscess by an infected foreign body in the bronchus, both clinically and experimentally, and the equally close parallelism in the times of onset of pulmonary suppuration observed clinically and experimentally would seem to place the embolic theory of post-operative pulmonary suppuration on a much firmer footing than the aspiration theory. The former also accounts quite adequately for those cases of pulmonary suppuration that follow the use of local anæsthesia. Moreover, it falls directly in line with Cutler's⁷ theory that most post-operative pulmonary complications are probably due to a factor common to all operations, namely the transportation of emboli by way of the blood stream to the pulmonary capillary bed. The subsequent reaction of the lung to such an embolus depends largely upon whether or not the embolus is infected, upon the type of the infecting organism, and upon its virulence. Cutler has pointed out that the greatest incidence of the simpler pulmonary complications, such as a transient fever and tachypnea, or a bronchopneumonia, is found in operations of the upper abdomen where emboli are more likely to be dislodged and catapulted into the blood stream by the constant movement of the organs and

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tissues in this region due to respiration. On the other hand, the least incidence in pulmonary complications occurs in operations upon the scalp and cranium. Here the tissues are rigidly immobile, and not subject to muscular contraction.

If the embolic theory is the more important of the two, why are so many pulmonary abscesses directly traceable to tonsillectomy, to the extraction of teeth, or to operations about the mouth, and so very few, comparatively speaking, traceable to the numerous operations performed in other parts of the body?

In an explanation of this Fetterolf and Fox have directed attention, first, to the sloughing that occurs in the mouth directly upon the surface of the pterygoid and pharyngeal muscles following the complete enucleation of the tonsil and second, to the constant movement of these muscles of the throat and neck. The first factor they say, favors septic thrombosis in the vessels and the second factor causes dislodgement of the infected emboli into the blood stream. These suggestions may be still further elaborated. McLean⁵ and others have asserted that thrombosis is dependent upon infection and that clotting within vessels usually does not occur even though the intima be injured and lacerated if no infection is present.

The application here is obvious. In clean operations about the neck and other parts of the body bleeding is controlled by ligature and by retraction of the vessel walls without significant thrombosis within the vessels. If a post-operative complication should appear, due to a sterile embolus, suppuration is unlikely. However in operations about the mouth, thrombosis is likely to occur in many more of the vessels that are divided since their cut ends are invariably contaminated by infection. The resulting clot may organize and may remain safely anchored by attachment to the vessel wall. In other instances, however, the infection that precipitated the thrombosis may be responsible also for the failure of the clot to remain attached to the vessel wall, it is swept off into the blood stream and finds its way into the pulmonary circulation to raise what mischief it may. Is it possible that the negative pressure so frequently observed in the jugular vein may be partly responsible for the "sucking" of these loosened thrombi into the venous blood stream? This factor, in addition to the constant movement of the muscles of the neck and pharynx may play some part in the dislodgement and transference of the infected clot to the lungs. It may also be an additional factor in the high incidence of septic emboli from this particular field.

Since the advent of more careful and accurate physical and laboratory examinations, the incidence of recognized post-operative pulmonary complications has risen remarkably. Cutler finds that they occur in six per cent of all post-operative cases. If we accept the theory that these complications are embolic in origin, and that their manifestations are due to small aseptic pulmonary infarcts, is it not logical to assume that tonsillectomy may also have its incidence of emboli, the important difference being that a certain number may be septic emboli capable of producing abscesses in a manner identical with

that seen in the experimental animal? Studies by Moore⁶ indicate that we may expect a pulmonary abscess to occur once in every three thousand tonsillectomies. This probably does not represent the total number of pulmonary complications incident to tonsillectomy, if one may judge from Cutler's studies which show that we may expect some form of pulmonary complication once in every sixteen operations in other parts of the body. The following brief history illustrates a pulmonary complication following tonsillectomy probably due to an infarct from the operative field which did not, however, go on to the formation of an abscess. A small boy, six years of age, had a tonsillectomy performed under ether. He was discharged on the third day, apparently well. Nine days after the operation, he returned to the hospital dispensary with a history of having had three days of cough fever, night sweats and pain on the left side on breathing, which had confined him to bed but which were then much improved. Gradual and complete recovery followed. This observation suggests that an instructive line of investigation would be a careful study of all cases of tonsillectomy for eight to ten days following operation to determine the incidence of the minor pulmonary complications, as disclosed by fever, increased respiratory and pulse rates, and roentgenographic evidence of infarction or consolidation. If their occurrence as compared to similar complications following operations elsewhere in the body, was found to be unusually high, it might throw additional light on the high incidence of pulmonary abscess following tonsillectomy. It is possible, also, that a study of large numbers of septic abdominal conditions requiring operation, and capable of throwing infected emboli into the blood stream, would show an incidence of pulmonary suppuration comparable with that following tonsillectomy.

SUMMARY

Experimentally, it has been found impossible to produce a pulmonary abscess by the introduction of septic material into the bronchus. Clinically a true pulmonary abscess rarely develops in the presence of aspirated infected foreign bodies.

Pulmonary abscesses may be produced, experimentally, with uniform success by the introduction of septic emboli into the venous blood stream. Clinically, the development of post-operative pulmonary suppuration parallels closely the development of a pulmonary abscess in the experimental animal.

It is suggested that the protective barrier to the formation of an abscess in the aspiration cases is an intact blood supply. In septic infarction due to infected emboli, the blood supply is interrupted, and in the presence of infection the ill-nourished, necrotic pulmonary tissue undergoes liquefaction and cavitation.

A similar process of thrombosis and septic necrosis of pulmonary tissue may be the important factors in the mechanism of the production of the pulmonary abscesses that follow bronchopneumonia.

We are led to conclude from experimental and clinical observations that

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post-operative pulmonary suppuration probably has its origin less often in the aspiration of blood and mucus than in the setting free of a septic embolus into the blood stream

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THE TREATMENT OF TRAUMATIC RUPTURE OF THE KIDNEY^{*}

By MILEY B. WESSON, M.D.

OF SAN FRANCISCO, CAL.

TRAUMATIC rupture of the kidney is not a rare lesion, although its treatment in text-books would indicate that it was very uncommon. Practically every surgeon has seen one or more cases, few have seen many and with rare exceptions only the unusual, complicated cases are recorded in the literature. However, newspapers have reported in the past two years that the football team of a local high school has suffered the loss of two players during games from traumatic rupture of the kidney, nephrectomy being done in each instance.

Although Galen¹ in 1561 described subcutaneous rupture of the kidney, little attention was paid to the lesion until the classical work of Rayer² in 1839. Since that time the literature has become voluminous. Various writers, reporting from one to six personal cases, have attempted to collect and analyze all of the instances recorded in the literature but, apparently because of the inaccessibility to the authors of many of the original articles, all of the tabulations are incomplete even though some reports contain over nine hundred cases. The statistics as to the incidence of ruptured kidneys vary markedly, Kuster^{3,4} finding ten cases in 30,000 admissions to the Basle Clinic. In 7741 autopsies, over a period of twenty years, he found that it occurred in 0.12 per cent of all instances and in 8 per cent of the deaths due to traumatic injury. Gutterbock⁵ in 326 post-mortem examinations, found kidney ruptures present in 10 per cent of the cases.

The subject of treatment has always been controversial, there being ardent advocates of the three types of treatment—expectant, conservative surgery and nephrectomy. With the advent of workmen's compensation insurance other factors than pure science have complicated the problem. The layman has been educated to the idea that pain in the back be it due to lumbago or secondary to a prostatitis, indicates kidney trouble. Hence, if there has been any trauma, this is as good a complaint for malingerers and as expensive for employers as the railroad spine of a decade ago or the more modern hypertrophic osteoarthritis. The insurance carrier wants the man back at work as soon as possible, preferably with two kidneys, and at a minimum expense.

Five instances of rupture of the kidney in which the patients were returned to work with both kidneys, one and one-half kidneys or one kidney, are briefly reported.

Etiology—After a careful review of the literature, one is amazed at the frequency of kidney ruptures that follow inadequate force,⁶ the degree of damage being out of proportion to the amount of injury, for instance who

^{*} Read before the Nevada State Medical Association, September 5, 1925.

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would suspect that a man would fracture his wife's kidney while waltzing with her⁷ or a boxer receive such an injury while delivering a blow⁸

Morris⁹ was the first to ascribe to the floating ribs a certain share in the production of rupture of the kidney. Rayet² and Tuffier¹⁰ called attention to the jarring caused by a blow on the body, Le Dentu¹¹ compared the injury to that experienced by the brain from a blow on the opposite side, Gutelbock⁵ suggested that a force squeezed the poles together, thereby producing transverse fissures, Schede¹² emphasized the possibility of throwing a distended kidney against the transverse process of a vertebra, while Kuster³ attributed most of the trouble to hydraulic pressure acting through the full vessels and pelvis and causing the organs to burst along the lines for the most part radiating from the tubules toward the point of maximum impact of the lower ribs, the opposing resistance being supplied by the vertebral column. However, the commonest modes of injury are (1) A blow driving the kidney against the lower ribs or transverse processes of the first and second lumbar vertebrae, (2) concussion, and (3) abrupt flexion of the body.

Although it is the general impression that infected kidneys rupture more easily than uninfected ones,¹³ there are no statistics available. Without doubt infection plays a very important part in the etiology of cases of non-traumatic rupture but is of little causative significance in cases due to external violence.¹⁴

Spontaneous rupture of the kidney is of particular interest because of the widespread interest in the new Wagner-Jauregg paresis therapy. Wade¹⁵ reported a bilateral rupture following antisyphilitic treatment in a case complicated with malaria. Connell,¹⁶ in 1916, collected from the literature 30 cases of spontaneous rupture due to arteriosclerosis, nephritis, stone, etc., any one of which could have been attributed to trauma and classified as an industrial accident.

Pathology—The most satisfactory classification of kidney ruptures is that of Tuffier¹⁰ (1) Ecchymosis (2) subcapsular rupture, and (3) total rupture. The subcapsular ruptures are considered benign, the injuries being followed only by infarcts, whereas the total rupture with a torn capsule and a laceration of the kidney pelvis is dangerous because of extravasation of blood and urine.

Injuries to the kidney are more common in males and the right kidney is most often the ruptured one, the posterior surface being the site of injury. A single tear is practically always transverse because the development of the kidney is parallel to the course of the tubules and vessels.¹⁷

Urine in the cellular tissue indicates a torn pelvis or ruptured calyx laid open,^{18, 19, 20} since torn renal substance is not capable of secreting urine. If the urine is sterile and is not disturbed, it walls off and is generally absorbed, but if it becomes infected, suppuration follows. Peritoneal tears are common in children under ten on account of the connection between the peritoneum and the kidney.^{12, 22}

Hæmorrhage can be classified in four groups (1) Hæmaturia, (2) perirenal, (3) intra renal, and (4) intraperitoneal. If the capsule is not torn, the

resistance will increase gradually as the blood is poured out and tend spontaneously to arrest the hemorrhage. When the capsule is torn and the kidney deeply lacerated, but the perinephritic tissue not much disturbed, the blood and urine will accumulate about it, forming a pseudohydronephrosis. Morgagni²³ noted that when a kidney was severely lacerated the free hemorrhage from its substance so lessened the blood pressure that there was often an arrest of renal secretion in the injured side. The renal artery is sometimes torn off and stops bleeding, thrombosis occurring while there is a balance of pressure between the blood clots behind the peritoneum and the blood pressure within the artery. However, as a rule, the main artery is seldom damaged and the death of the part involved does not necessarily follow the occlusion of a branch. A large hemorrhage into the peritoneal cavity is fatal because of the lack of counter pressure, hæmaturia is generally absent because of clots in the ureter²⁴ and shock is the only symptom.

The mechanism of wound repair in the kidney is essentially the same as in any other parenchymatous organ—i.e., the proliferation of the interstitial connective tissue of the gland bridges the gap between the two edges with the aid of a clot. The functioning elements of the gland degenerate and are replaced by connective tissue. Scar formation is rapid in the kidney and the process of repair has been shown far advanced after six days. The parenchyma is replaced by common scar tissue which is slowly permeated by scant newly-formed capillaries. There is no regeneration of tubules or glomeruli for the kidney is no more able to replace its glandular elements than is any other highly specialized organ.

Renal Counterbalance —Buried in the foreign literature are reports of an immense amount of experimental work on the quantity of renal parenchyma necessary for life and it is agreed that one-fourth to one-third the combined weight of the two kidneys is sufficient²⁵. However, this extreme reduction of the secretory field can last for only a few days the temporarily stored up excrementitious substances causing grave symptoms of uremic intoxication, unless the remaining portion of the kidney has undergone a compensation hypertrophy in size and functional activity of the surviving elements that will care for it²⁶. Numerous investigations proved that the hypertrophy was completed in 20 to 25 days and there was an increase of one-fifth to one-sixth in kidney volume. Dolgoff²⁷ found in dogs with a single kidney that any injury to cortex or medulla was fatal. Franklin²⁸ successfully removed one and three-fifths kidneys from a child suffering from bilateral traumatic rupture.

Symptoms —The regulation train of events is. A fall, "felt sick," hæmaturia, dysuria and shock. The most characteristic symptom is hæmaturia and it is present in 90 to 95 per cent of the cases. If the ureter and pelvis is torn off or the bleeding is into the peritoneal cavity, there will be no blood in the urine²⁹. Hæmaturia is of minor importance, being merely the signal, the hæmatoma the measure of the lesion. Occasionally the tumor in the loin does

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not appear until the seventh day or if the hemorrhage follows the sheath of the spermatics it may not reach the inguinal rings or roots of the penis until several weeks later.³⁰ Without incision or pyelograms it is impossible to tell whether or not the capsule is ruptured. Kolischer and Eisenstaedt³¹ diagnosed a rupture of the kidney a week after the injury because of a persistent ecchymotic spot in the right flank and the observation through a cystoscope of the passage of a clot from the ureter.

Shock that comes on after a lapse of several hours is due to hemorrhage whereas if it occurs at time of injury it is not due to the kidney lesion but to an injury to the solar plexus. Reflex anuria of the uninjured kidney is not unusual and has even caused death. Even more interesting is reflex pain. Fieschi³² described an instance where the surgeon was misled by the location of the pain and cut down on the uninjured kidney. Marshall reported a case of traumatic rupture of the kidney treated by expectant method that returned to work on



FIG 1.—Pyelogram of a healed kidney three months after a traumatic rupture with retroperitoneal extravasation of urine, excision and drainage one month later. One-half of the kidney being destroyed, its function is reduced 50 per cent.

the twelfth day and developed severe pain on the 130th day due to sub-acute bilateral nephritis not dependent upon previous trauma but undoubtedly of infective origin. The nerves of a kidney are in the pelvis and not in the cortex, hence there can be no pain in a damaged kidney unless there is a pull on the renal pedicle.³³ Papin³⁵ and Ambard³⁶ have demonstrated that the kidney in its normal location is insensitive to pain and if the organ is exposed under the influence of a local anæsthetic, pinching it or doing a nephrotomy is painless. In other words, there can be no kidney pain as an aftermath of a traumatic rupture unless there is intrapelvic back pressure.

Treatment—The treatment of rupture of the kidney has not yet been standardized³⁷ and unfortunately these organs are being handled today as were ovaries a generation ago, when it was a fad to remove them for trivial reasons

The common procedures are (1) Expectant treatment (let alone or later operation) for injuries where constitutional symptoms are absent and hæmaturia alone directs attention to the probability of a kidney lesion, (2) conservative surgery (tampon, suture or debridement) for a damaged kidney with a torn capsule, (3) nephrectomy for a destroyed kidney, and (4) abdominal incision for a torn peritoneum

One would judge from the cases reported in the literature that nephrectomy was still the routine procedure. However, it is generally agreed that if the renal substance alone is only moderately injured, the pedicle being intact, conservative surgery is indicated. It is criminal to routinely do a primary nephrectomy, that procedure being reserved as a late operation,³⁸ and particularly when there is a widespread infection.³⁹ A fever does not necessarily indicate infection, as absorption of blood and urine will cause an elevation of temperature after a lapse of five to seven days.

A renal injury of moderate degree tends to recover spontaneously, but expectant treatment with rest in bed and an ice cap over the injured side for at least 48 hours should be insisted upon in all cases until the dangers from possible unusual complicating factors are over.⁴⁰ The indications for exploration are (a) immediate severe renal hemorrhage which endangers the patient's life, (b) steady hourly rise in pulse rate, and (c) anemia due to continuous moderate hemorrhage over many days. The recognized indications for nephrectomy are (1) tearing of the renal pedicle, (2) lacerations of the kidney in several places, (3) a tear extending toward the renal pelvis in a kidney whose short pedicle prevents delivering it so as to expose the rent for suturing, (4) an extensive tear in the renal pelvis which can not be repaired or a complete tear across the ureter and (5) hydronephrosis or other severe disease of the injured kidney. Aside from severe hemorrhage there is no other justification for operation except infection. Since hæmatomata are easily infected faithful supervision of the case is absolutely necessary if conservatism is attempted. Instrumentation is to be avoided when possible because of the danger of infection. However large quantities of blood in the bladder with consequent clotting may lead to distention or tenesmus and require aspiration with a "clot sucker." Early and accurate diagnosis and prompt exploration in appropriate cases is imperative.

Prognosis—Deep laceration and severe contusion are not fatal, a healed specimen in New York Hospital shows a complete horizontal division. In those unfortunates with a single kidney, a severe injury to that organ is probably always fatal.

It is fairly clear from a report of cases that more lives might be saved if timely operations were judiciously performed, and also that many nephrectomies could have been avoided if surgeons had not considered hæmaturia and

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the history of a fall an indication for operation. In all cases treated expectantly, operation, if performed, should not be delayed too long.

Abdominal tumors may follow kidney ruptures that are treated expectantly. The swelling is not necessarily an effusion due to a necrotic kidney²⁰ acting as an irritant on the remains of a hemorrhage, but may be an accumulation of urine. When this is evacuated so as to relieve the pressure, the kidney and ureter will resume their normal function.

The argument is fallacious which assumes that the cases operated upon are the most severe and those not operated upon are the slightest injuries, also, the conclusion that if many of those treated palliatively had been operated upon, the mortality would have been materially further reduced. It must be admitted that the expectant plan is necessarily adopted in some of the very severest as well as in the slightest cases.

The comparative statistics in the literature are valueless and misleading since they are based either on false premises or an insufficient number of

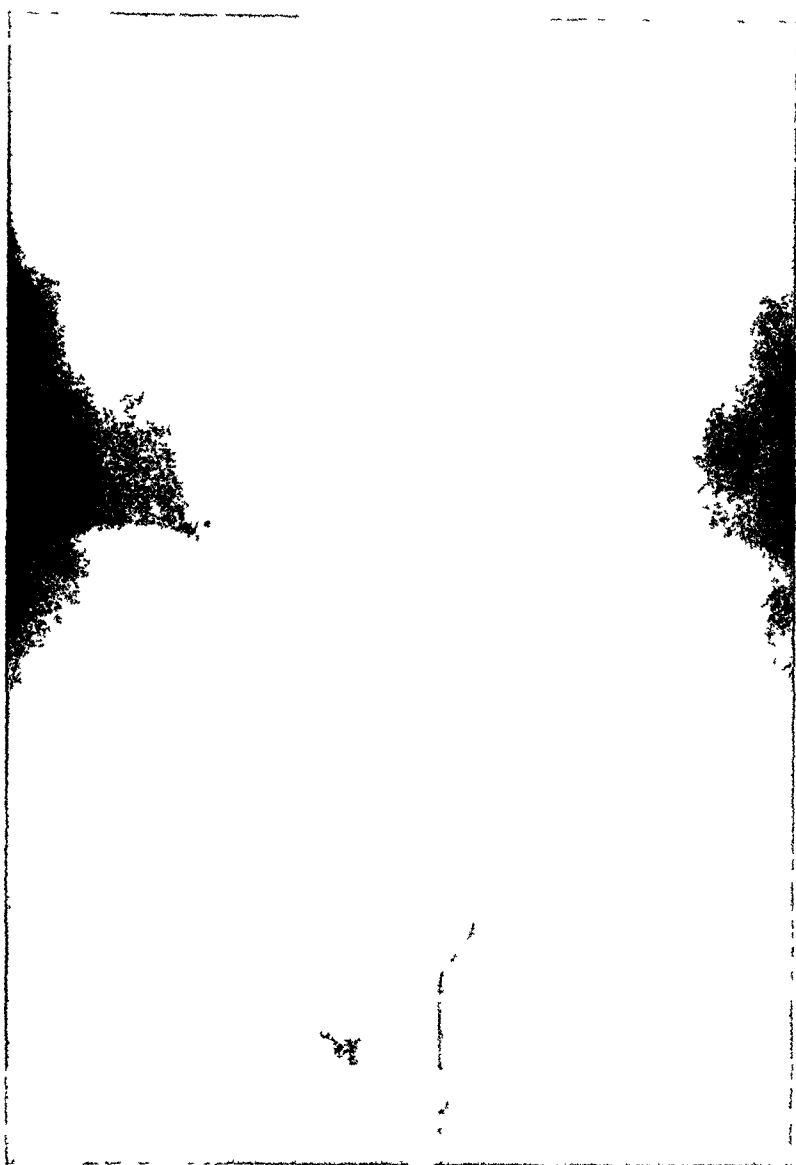


FIG 2.—Overinjection with extravasation of 13½ per cent sodium iodide solution between the tubules. Fig. 1 was made with an 18-inch column (gravity) and Fig. 2 by elevating the column to 24 inches. There was no pain and no reaction.

cases. Riese⁴¹ in 1903, in 490 cases, found the mortality to be in expectant cases 21 per cent, conservative surgery 12 per cent, and nephrectomy 18 per cent. Lardennois⁴² in an analysis of 767 cases in 1908 found a mortality of 20 per cent in uncomplicated untreated cases, 28 per cent in the expectant or late operation group, and 18 per cent in the cases operated upon immediately. Ponomareff⁴³ reported, in detail, a series of 123 cases (57 personal) treated expectantly with a mortality of 9 per cent.

One would expect that the reports from the various State Industrial Acci-

dent Commissions would furnish accurate data as to the amount of impairment arising from a ruptured kidney. However, their data is not tabulated and too often their ratings are copied bodily from the obsolete French reports,⁴⁴ where Ollive and Le Meignen⁴⁵ rated nephrectomy cases as having 40 to 50 per cent total disability. The California Industrial Accident Commission considers the loss of a kidney as equal to the loss of an eye⁴⁶ and rates them at 20 per cent, or 80 weeks compensation. This fact is apparently not generally known for although many industrial nephrectomies are done,⁴⁷ less than 6 cases have appeared in the last three years before the Commission for a rating.

The life insurance companies take a more optimistic view of the after effects of such an injury. The most conservative hold that a nephrectomy on a forty-year-old man impairs him to the same extent as a blood pressure of 160 mm. Gage⁴⁸ however, holds that "rupture of the kidney may be followed by complete recovery and leave no trace of the damage. Even if the injury requires the removal of the kidney, the other kidney quickly accommodates itself to the extra work and performs its function without any tendency to early degeneration. Such cases are probably at least average risks."

Discussion —The time element in the cases treated without operation is an important and expensive factor for the insurance carrier. If a nephrectomy is done a man either promptly gets well or dies, whereas if following expectant treatment he complains of pain, a subjective symptom the presence or absence of which can not be demonstrated, he may become as expensive as the old-time "railroad spine" case. A careful, detailed study of the literature furnishes not one authentic case of pain in an uninfected healed kidney, furthermore, careful physiological researches have adduced no evidence that pain is possible. In those cases where there is no pull on the renal pedicle and no infection, the complaint of pain should receive no consideration. If a workman with one and one-half kidneys has his good kidney destroyed by subsequent injury, the organ first injured will take over all the kidney function, whereas if radical surgery had been done, there would be an immediate exitus. A healed kidney, free of infection and casts, with a good phthalein and no evidence of defective drainage of the pelvis can not be a source of pain. Conservative treatment is best for the man, but if expensive imaginary pain keeps a man on the compensation list for months, it becomes an important factor and it will only be a question of time until nephrectomy will become the routine treatment.

The appended brief case reports illustrate various degrees of kidney injuries and their treatment.

CASE I (No 303) —S. G., thirty-two-year-old male, was crushed between a moving car and a tunnel wall on April 14, 1914. The following day, when seen by W. H. Winterberg he was voiding bright red blood. The profound shock and abdominal rigidity pointed toward internal injuries. After twenty-four hours expectant treatment the urine was clear, a voided second glass specimen was sterile. The right side of the abdomen was relatively soft but the left was rigid as a board and exquisitely tender. This condition disappeared very slowly, and hence he was not discharged from the hospital until May 14, he voluntarily returned to duty on June 28, 1924.

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Comment—The hemorrhage stopped spontaneously, the rigidity of the left side was apparently due to extravasation of blood in the muscles which was slow in absorbing

CASE II (No 397)—R P, an eight-year-old male, was run over by an automobile on September 16, 1924. He was carried to a hospital in a state of shock, and with a fracture of the right iliac bone and crushed left second, third and fourth vertebræ. His first voiding was bloody but as his urine promptly cleared up, no attention was paid to this symptom. He was discharged on October 3, his only apparent impairment being a waddling gait. A fullness gradually developed on the left side. When I saw him on November 17, 1924, a radiogram showed the abdominal organs to have been pushed to the right of the midline. An attempt to pass a catheter to the left kidney failed, it entered the ureter a distance of 5 cm and after passing through the intramural portion, turned sharply to the left.

Operation and Results—November 19, 1924, under gas, oxygen and ether anæsthesia, a lumbar incision was made and a sac was opened from which were evacuated three quarts of clear fluid containing urea. The retroperitoneal sac extended anterior to the pubic bone, and there were calcareous deposits on its walls. At the upper angle an apparently normal kidney could be felt behind the sac. A drainage tube was inserted and the incision closed. Phenol-

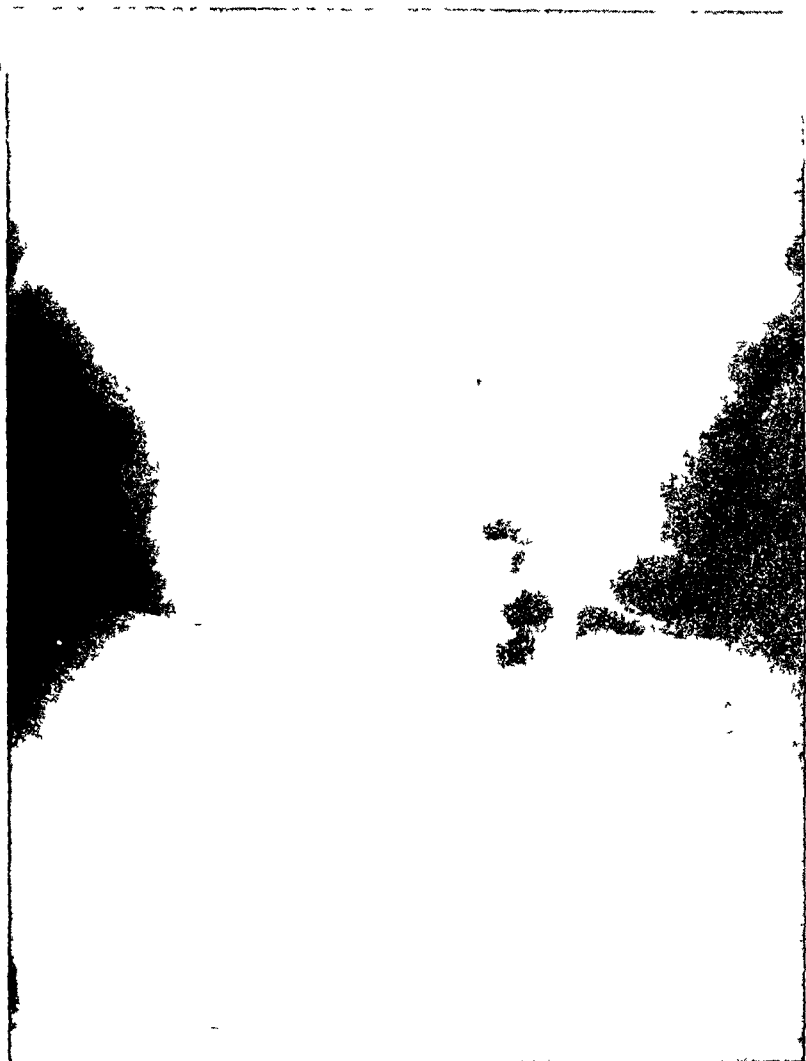


FIG 3—Pyelogram made 33 days after rupture of upper calyx. The sodium iodide passed through the rupture to the surface and then flowed around the kidney—beneath the capsule.

sulphonaphthalein injected intravenously was recovered in small amounts from the drainage tube, most of the dye passing through the bladder. Later a cystoscopy showed indigocarmine coming from both ureters as well as from the drainage tube. An attempt was made to do a pyelogram through the fistula but this was only partially successful. The fistula healed in six weeks and the child is now in perfect health.

Comment—At the time of the accident there was a rupture of the kidney pelvis. Eventually the walled-off urine increased in amount sufficient to interfere with the course of the ureter, causing it to form an acute angle, and the sac consequently increased enormously in size. When the contents of the pouch were evacuated so as to unkink the ureter the urine resumed its course through the normal channel.

CASE III (No 360)—M D, a forty-year-old male, on May 13, 1924, fell from a

hand-car a distance of three feet, striking his left side on a car rail. He voided blood-stained urine but as this cleared up in a few days its significance was apparently not recognized. The case was treated expectantly and the fever and leucocytosis that developed were attributed to a pneumonic condition as he had bloody expectoration. On June 9 he was transferred to the nearest city to a surgeon, as he had a tumor mass on the left side "the size of a small watermelon" and his leucocyte count was 20,000. A left lumbar incision was made by June Harris of Sacramento and "practically a gallon" of urine was evacuated and a drainage tube inserted. A cystoscopy done several days later by E. W. Beach showed no urine coming from the left kidney although a picture showed the

catheter in the pelvis. The drain was removed and the wound healed promptly. Because of his refusal to return to work, his compensation and lodge sick benefits exceeding his normal income, he was referred by the insurance company to me for a complete urological examination. The urica and the phenolsulphonephthalein tests and the pyelograms showed a partial destruction of the left kidney (Figs 1 and 2). There were no casts and no infection, hence no need of treatment. He returned to work on October 1, 1924.

Comment—A fall of three feet resulted in a traumatic rupture of the kidney with retroperitoneal extravasation of urine. Following the evacuation of the urine the kidney healed. As a result of the rupture



FIG 4—Same case as Fig 3 but made one year later. Patient was in an upright position hence there was no ptosis of the half kidney which was uninfected and had a reduction of 50 per cent in function (Courtesy of R. L. Rigdon.)

and the consequent process of repair at least one-half of the secretory part of the kidney was destroyed. Instead of having two kidneys he has one and one-half kidneys, a reserve of 50 per cent instead of 100 per cent.

CASE IV (No 335)—J. H., a forty-five-year-old male, on June 1, 1924, fell down a ship's hatch, a distance of twenty-five feet, striking on his right side and breaking a number of ribs. He was seen a few hours later by W. H. Winterberg and at that time voided bright red blood. This continued in decreasing amounts for thirty-three days. The bleeding was stopped by injecting, by gravity, with a twenty-four inch column, a 13½ per cent sodium iodide solution to make the accompanying pyelogram (Fig 3). The urine was uninfected and the function from the right side was 50 per cent of normal. The patient's recovery was uneventful. Two months later a total phenolsulphonephthalein was done and 60 per cent of the dye was excreted in one hour. His only complaint was that when he leaned over there was pain in the lower lumbar region. His prostate and seminal

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vesicles were found to be very tender and to contain pus. A sacro-iliac belt was prescribed and he was given light work as a railroad porter, when his belt was tight he noticed no pain when stooping over to pick up two armfuls of grips. He began to indulge freely in the use of alcohol and some of his convivial friends told him that he needed treatment for his kidneys and that there was no need of working for he could draw pay as long as he was taking treatment. At this time he transferred his pain from the sacro-iliac region to the right loin, and a consultant advised a nephrectomy because of the pain. Two independent examinations made by eminent urologists showed uninfected urine, no casts, a destruction of one-half of his right kidney (Fig 4), and with a phthalein output of 50 per cent of normal from the damaged kidney. The kidney was in normal position, the pelvis not dilated and there being no objective evidence of the presence of pain, a nephrectomy or other treatment was not indicated so he was ordered back to work.

Comment—A subcapsular fracture of the kidney with hæmaturia persisted for thirty-three days and was stopped by a lavage of sodium iodide used to make a pyelogram. The pictures showed a destruction of the upper one-half of the kidney with the fluid around the kidney beneath the capsule. Pyelograms made one year later showed the upper calyx replaced by scar tissue, the surviving portion of the kidney being normal in all ways.

Since the kidney did not move with change of position, the ureter was not kinked or structured, the pelvis was not dilated, there was no possibility of extra-renal adhesions (the extravasation being subcapsular) and no infection as indicated by the absence of casts, pus or organisms, there was no evidence that pain could exist, hence there was no compensatory disability. The patient's reserve is merely reduced 50 per cent or one-half kidney. The pain was undoubtedly due to his prostatitis and seminal vesiculitis.

CASE V—(Reported through the courtesy of Dr. John F. Pruett)—M. L., fifty-one-year-old ship steward, in March, 1921, while making up beds struck his right loin against the corner of a berth. This was followed by severe local pain and fever. An abscess opened spontaneously at the site of the injury on July 15, 1921. He had become very weak and emaciated, had an afternoon elevation of temperature and a pulmonary examination disclosed showers of moist râles. However, repeated examination of the sputum, urine, and pus from the sinus were negative for tubercle bacilli. An X-ray showed stones in the right kidney. The bladder urine contained pus, *B. coli* and staphylococci. A cysto-



FIG 5—Pyelogram and ureterogram made by injecting a fistula with Beck's paste. Traumatic rupture by external violence of a kidney containing two stones, abscess with fistula developed four months later.

scopic examination revealed a bilateral renal infection, a normal phthalein output from the left side and only a trace from the right. The left pyelogram was practically normal. The sinus was injected with Beck's paste and found to connect with the right pelvis (Fig 5). A successful nephrectomy was done and in July, 1924 the patient, who had returned to his home in Spain, wrote that he was in perfect health.

Comment—A pyelogram and ureterogram from an injection of Beck's paste in a fistula that developed following a blow in the loin.

CONCLUSIONS

1 Of all the internal catastrophes a ruptured kidney treated under modern conditions offers the best prospect for a complete recovery.

2 Subcutaneous ruptures of the kidney heal without operation and with a function loss of approximately 50 per cent.

3 Before nephrectomy there should be an investigation as to the condition of the opposite kidney.

4 Bladder catheterization is to be avoided when possible because of the danger of infection.

5 Death never occurs from hæmaturia, *per se*, but blood clots in a bladder furnish ideal culture media for a catheter infection with ultimate exitus.

6 By saving a ruptured kidney we preserve a useful organ, even though its function is somewhat impaired by the cicatricial bands strangulating some of the parenchymatous elements of the organ and in case of subsequent destruction of the uninjured kidney the impaired one is able to do all of the work.

7 Subjective pain is not a compensatory disability in a healed ruptured kidney, (1) that is in the proper location, (2) does not move with change of position, (3) the pelvis is not distorted, (4) the function is reduced one-half, and (5) the urine contains no casts, pus or organisms.

8 Hæmaturia is not an indication for operation, being merely a signal while the hæmatoma is the measure of the lesion. An elevation of temperature may be due to absorption of blood and not to infection.

9 The kidney should be exposed when there is severe hemorrhage indicated by (1) falling blood pressure, (2) rising pulse rate, (3) decreasing hæmoglobin, and (4) an unsatisfactory general condition.

10 Primary nephrectomy should not be done except for a torn renal pedicle.

11 Conservative surgery consisting of the use of tampons or suturing should be the routine primary operative procedure.

12 The operative treatment of rupture of the kidney is secondary to the therapy of shock.

13 Five different types of cured kidney ruptures are reported.

a Persistent board-like rigidity of left abdominal wall, accompanied by hæmaturia, cure followed expectant treatment.

b Walled-off urinary extravasation (in a child) manifested itself two months after injury, treated by incisions and drainage of sac.

c Walled off urinary extravasation (in adult) operated upon two months after injury because of fever, leucocytosis and tumor, treated by incision and drainage with a loss of only 50 per cent function on that side.

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d A subcapsular rupture of the kidney treated expectantly with a loss of 50 per cent function in the damaged kidney

e A rupture of an infected kidney containing stones with the formation of an external fistula that discharged pus but no urine. An injection of the fistula produced a pyelogram and ueterogram. Nephrectomy

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TREATMENT OF OBSTRUCTIONS OF THE UPPER URETER AND EARLY HYDRONEPHROSIS*

BY CHARLES H. PECK, M.D.
OF NEW YORK, N. Y.

THE procedure described in this report, first used on February 7, 1910, and first reported, before this Association, at the meeting in Rochester, Minn., in June 1915, is simply one step in the technic of operations performed for the relief of obstructions of the upper ureter. It has perhaps, its greatest sphere of usefulness in the types of obstruction associated with early hydronephrosis in which the dilated pelvis pouches downward, hooding over the pelvi-ureteral junction, and when tensely distended causing lateral, valve-like

pressure at the pelvic outlet, sufficient in itself to cause complete urinary obstruction, whether it be the only cause of such obstruction (as in my second case, operated upon in October, 1911), or superimposed upon some other preexisting cause, as in my first case, in which a small

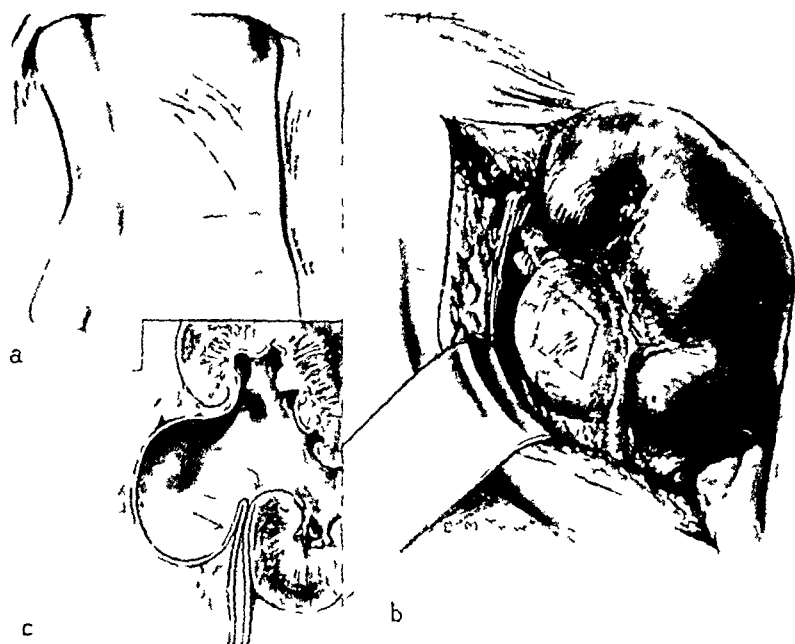


FIG. 1.—a Lumbar incision b Hydronephrotic kidney, lines of excision for plastic on pelvis c Dilated pelvis showing valvular compression at pelvi-ureteral junction

calculus acting as an intermittent ball-valve obstruction, was undoubtedly the primary cause of the hydronephrosis and pelvic pouching.

The procedure consists simply in passing a stiff ureteral catheter through a stab wound in the cortex of the kidney, down the ureter to the bladder, leaving it in place to act as a splint to prevent bends or kinks in the ureter, and especially at the pelvi-ureteral junction during the first few days after operation, while the kidney and ureter are becoming fixed in their new position necessarily differing in some degree from its pre-operative position, owing to the lifting out and replacement of the kidney in the course of the operation.

*Read before the American Surgical Association, May 5, 1925

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With such a splint in place obstructive kinks or bends cannot occur, and by the time it is removed, after three to five days, they are unlikely to occur, as the fixation of kidney and ureter in position has been accomplished.

The splinting is, of course, only one step in the operative procedure, which must vary according to the lesion present, *e g*, removal of calculi, dilatation of high ureteral strictures, division of crossing vessels or fibrous bands which have caused obstruction, plication or plastic operation on a dilated pouching pelvis, nephropexy to fix a movable prolapsing kidney. We have met with all of these conditions in the short series of cases in which we have used the splinting operation.

That it may aid in controlling pyelitis of a moderate severity, by improved drainage, is strikingly shown in one of our recent cases, in which it not only relieved the local condition of an infected and dilated pelvis, and thereby saved the kidney from further damage and probable destruction, but it also



FIG. 2—Suture of pelvis after excision of segment from posterior wall

relieved a constitutional sepsis of several months' duration, which had been causing a marked debility and depression of the patient's general health.

CASE REPORTS

CASE I—A man, aged thirty-five years, had been ill for several months with a colon bacillus infection of the right kidney. Constantly recurring pain, with elevation of temperature and leukocytosis, bladder irritability, loss of weight and general debility persisted throughout the summer and autumn of 1923. The urine cultured larger numbers of colon bacillus repeatedly. Cystoscopy showed dilatation of the right kidney pelvis and an apparent incomplete obstruction of the upper ureter near the pelvis. The passage of bougies and attempts to irrigate the kidney pelvis failed to relieve the condition and it was feared that removal of the kidney was becoming inevitable. The proposed attempt to save the kidney, the uncertainty that it would prove feasible,

the chances of failure if the attempt were made, with the need of later nephrectomy, were all explained frankly to the patient, who gave free consent to an attempt to save the kidney, which might fail, or to immediate nephrectomy if it seemed advisable. The left kidney function was normal and it was not infected.

Operation, performed December 19, 1923. The kidney was much enlarged, the cortex thinned and lobulated, but there was still a good amount of comparatively normal kidney substance left. The pelvis was dilated, the upper ureter seemed constricted, its implantation was high and the pelvis hooded below, causing valvular obstruction. The perirenal fat was inflamed and adherent to the pelvic wall which had lost something of its normal thinness and elasticity. No calculi could be felt nor were any found later.

The question of nephrectomy was discussed, but it was determined to try to save the kidney by relief of the obstruction and better drainage. The pelvis was opened by a posterior incision and explored with the finger, the calyces were much dilated, there were no calculi. A ureteral catheter was passed through the opening down to the bladder, there was a tight stricture of the ureter near the pelvis which barely admitted the catheter. This was dilated with a metal probe to a normal calibre. A nephrotomy stab wound was made near the convex border of the cortex and a stiff ureteral catheter passed through it down the ureter to the bladder and left in place, its proximal end protruding from the main wound. An ovoid segment was then excised from the posterior wall of the pelvis, and the defect was sutured transversely to take up slack and obliterate the hooding. Nephropexy was then performed, and a small drain placed down to the posterior surface of the kidney.

Recovery was uneventful, the ureteral catheter was removed on the fifth day and the drain to the kidney two days later. The symptoms of pyelitis and the fever and constitutional symptoms began to abate at once, and improved steadily to complete recovery. A letter received, dated December 20, 1924, one year post-operative, says: "There has been no return of the old trouble, the cystitis has entirely disappeared, the urine still shows a few colon bacilli, about four to the field, my general health is splendid."

That a lasting cure with preservation of the kidney may result is illustrated by some of my early cases, reported in detail in the former paper (*ANNALS OF SURGERY*, August, 1915, vol. LXII, p. 252), viz:

CASE II—Operated upon in 1910. Marked hydronephrosis with hooded pelvis and small calculus. Reported April 1, 1925, fifteen years post-operative. "Perfectly well, never had any return of kidney trouble."

CASE III—Operated upon October 25, 1911. Hydronephrosis with hooded pelvis and valvular obstruction. Reported perfectly well in the spring of 1924, thirteen years post-operative.

We have used the method in a variety of conditions not associated with a definite hydronephrosis, but due to some degree of ureteral obstruction, *e.g.*, a few cases of pyelitis which had resisted other treatment, dilating the ureter from above and placing the splint to insure better drainage, cases of recurrent, persistent kidney pain, in which it was impossible to demonstrate a definite pathology at the time of operation, but which were probably due to ureteral stricture or kinking. Cases of definite stricture or kinking, some caused by crossing vessels or bands with the ureter kinked by the descent of a movable kidney. In two recent cases of this latter type, symptoms began after a lifting strain and the attacks of pain persisted for several months until finally relieved by operation.

CASE IV—A man aged forty-three years, was admitted to the medical division of the Roosevelt Hospital, April 7, 1924, suffering from severe pain in the right lumbar region and persistent vomiting of ten days' duration, following a severe strain produced by lifting a heavy box of hardware. A careful workover showed no organic trouble in stomach, a pyelogram showed a slightly dilated right kidney pelvis, no calculi.

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He was treated on the medical service for about six weeks with rest in bed, restricted diet, etc., with improvement of stomach symptoms, but lumbar pain persisted, especially when allowed out of bed

He was transferred to the surgical division and operated upon May 20, 1924, the pre-operative diagnosis being nephroptosis following lifting strain, with ureteral kinking, probably at the pelvi-ureteral junction

The kidney appeared normal except for moderate dilatation of the pelvis, there was no distinct hooding, the ureteral implantation seemed normal there was no definite ureteral stricture, the kidney was somewhat ptosed and movable, no calculi were found

Through a stab wound in the cortex a metal ureteral probe was passed down the ureter to the bladder, followed on its removal by a stiff ureteral catheter, which was left in place as a splint. The pelvis was not incised and no plastic operation was done, nephropexy was performed.

Convalescence was uneventful, the splint was removed on the fifth day and the patient was allowed out of bed on the twelfth day. After the ordinary wound pain and soreness had subsided there was no return of the lumbar pain nor of the vomiting. The patient has been kept under observation and has remained entirely well.

While the pathologic findings were so slight as to be,

perhaps, open to question, we believe that this was a true case of beginning hydronephrosis due to kinking of the ureter.

The persistence of the pre-operative pain for a prolonged period, under careful observation and treatment, and its prompt relief following operation, seemed convincing proof that the pain was not a pure neurosis, a possibility which had been carefully considered during his pre-operative treatment.

CASE V—A young woman, aged twenty-one years, married, of robust physique and good general health, suffered from severe attacks of pain in the right lumbar region dating back to December, 1923. The attacks were at first infrequent, but became more frequent and severe up to early in July, 1924. Cystoscopy then showed a slightly



FIG 3—Suture of pelvis completed. Hooding and valvular compression corrected.

dilated pelvis of the right kidney and an apparent obstruction of the upper ureter about 4 cm below the pelvis. She was kept in the hospital a few days and discharged, as it was thought that the condition might improve without operation. The attacks continued all summer, and she was readmitted September 17, 1924. While resting in bed the pain was for the most part absent, but when out of bed or even sitting upright in bed the pain would recur. It was very severe at times, accompanied by sweating and sometimes by vomiting, never by fever or inflammatory symptoms. There was no pus in the urine, there was persistent, fairly marked tenderness over the right kidney. She was kept under observation without improvement until October 22, 1924, when operation was performed.

An aberrant artery, attached near the lower pole of the kidney, crossed the ureter

about two inches below the pelvis and apparently caused constriction or kinking when kidney slipped downward. The vessel was double ligated and divided. The kidney seemed quite normal, the pelvis showed little dilatation and the ureteral implantation was normal. Through a stab wound in the cortex a stiff ureteral catheter was passed down the ureter to the bladder and left as a splint, nephropexy was performed, and the appendix was removed through a short intermuscular incision. It showed no definite pathologic change. Recovery uneventful, the splint was re-

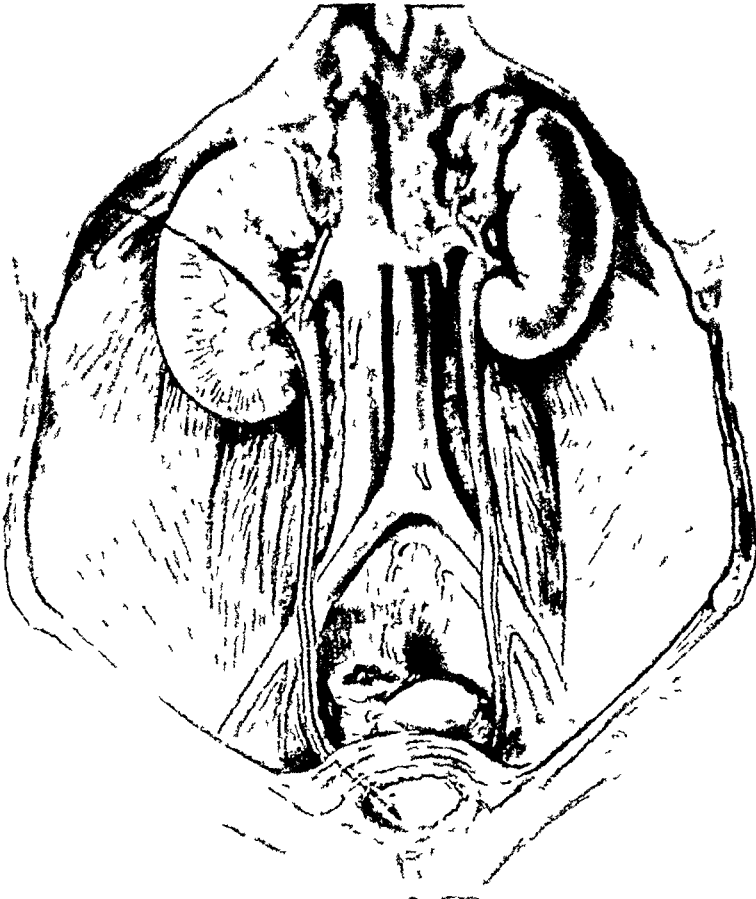


FIG 4 —Ureteral splint in place, kinking at pelvi-ureteral junction or in course of ureter cannot occur

removed on the sixth day, she was out of bed on the fourteenth day and was discharged well on the twentieth day after operation. She has been kept under observation and has remained well, entirely relieved of her former pain.

It may well be commented that in this case splinting was an unnecessary adjunct to the technic of the operation and that division of the aberrant vessel was sufficient. We believe, however, that this additional insurance against subsequent kinking and partial obstruction is worth while even in this type of case.

We have performed the operation on twenty-six cases, in only four of which were calculi present. In two of these latter a dilated and hooded pelvis with valvular obstruction was present. In seven others there was definite

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dilatation of the pelvis with valvular obstruction without calculi three cases only had a definite pyelitis, two associated with hydronephrosis, one without pelvic dilatation eleven cases had intermittent pain due to kinks or strictures of the upper ureter without definite dilatation of the kidney pelvis

There were two deaths in the series, due to complicating conditions, one a case of Graves' disease in which the kidney operation should not have been performed, and one with multiple calculi and infection, in which death followed secondary nephrectomy for kidney suppuration In no case which we have been able to follow has any relapse of the painful condition recurred nor has any subsequent trouble called for a secondary operation

We grant that the procedure of splinting may not have been the most important factor in the relief of symptoms in all of these cases, and reiterate

that its most important field of usefulness is in cases of early hydronephrosis with hooded pelvis and valvular obstruction at the pelvi-ureteral junction, or cases with a faulty implantation of the ureter causing obstruction and requiring a plastic procedure on the pelvis of the kidney In such

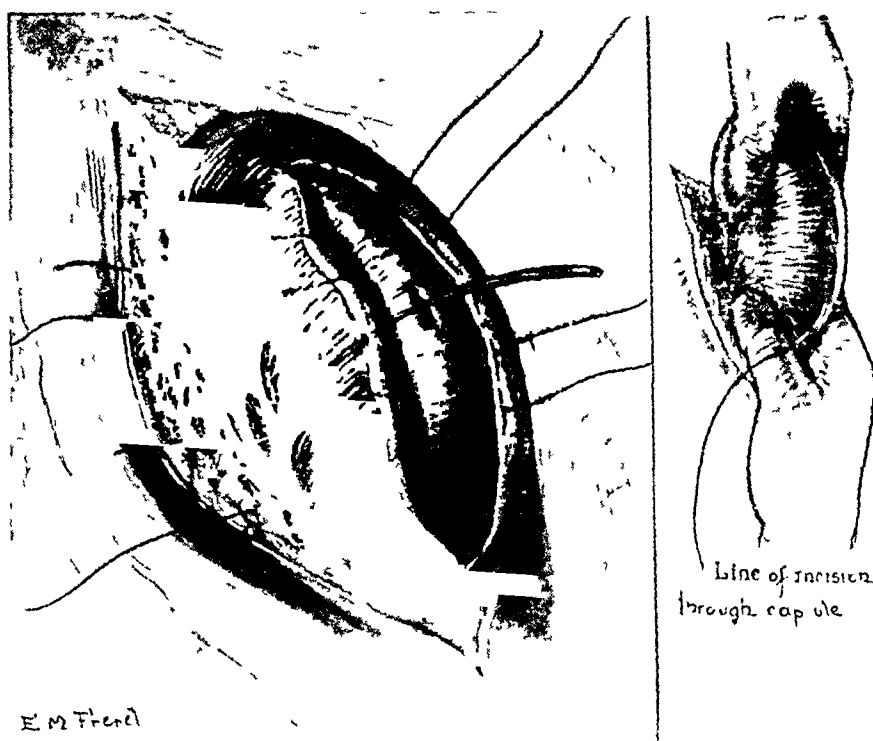


FIG 5—Sutures for nephropexy placed, catgut mattress suture tied round ureteral splint for hæmostasis

cases the prevention of a newly formed kink or valve is of prime importance, and splinting is an effective aid in such prevention Had I used the method in the case operated upon in 1919, and cited in detail in my former paper, in which complete anuria due to valvular obstruction and pyelitis developed in the remaining kidney after a previous left nephrectomy, the result might have been a less unhappy one The attempt to relieve the obstruction by a plastic operation on the pelvis failed and permanent urinary damage through the lumbar wound resulted It was the failure in this case that led me to adopt the method in subsequent operations

In studying the pathology of this group of kidney cases, one is impressed with the fact that small, apparently insignificant obstructive lesions or anatomical defects, for the most part easily dealt with in their early stages, can

soon cause serious damage and lead to complete destruction of a kidney if allowed to go untreated. We would also emphasize that kidneys in the earlier stages of hydronephrosis, even with fairly marked dilatation of pelvis and calyces and thinning of the cortex, may be well worth saving and should not be sacrificed simply because nephrectomy is easier for the surgeon and more certain to be followed by a brilliant immediate convalescence than a conservative operation.

Such a kidney saved may be of untold value should disaster befall its opposite neighbor at some future time.

SUMMARY

Splinting of the ureter is a useful adjunct to operative procedures for the relief of upper ureteral obstruction and early hydronephrosis, especially in the type with hooded pelvis and valvular obstruction at the pelvi-ureteral junction.

It is also useful in forms of painful obstruction, without dilated pelvis, usually in conjunction with probe dilatation of ureteral stricture and nephropexy.

In pyelitis with obstruction which has resisted conservative treatment, with or without a dilated pelvis, it may aid subsequent drainage enough to save a kidney threatened by damaging infection.

The procedure is simple, adds nothing to the operative risk and causes no damage to the ureter if the splint is removed within five or six days.

FRACTURES OF THE HEAD AND NECK OF THE RADIUS *

By CONDUCT W. CUTLER, JR., M.D.

OF NEW YORK, N. Y.

AMONG the bone injuries commonly met with, the fractures of the head and neck of the radius present several features of more than ordinary interest. While not so frequent in their occurrence as many of the other fractures, they are yet sufficiently numerous to warrant the study of the surgeon. The various opinions advanced with regard to the method of production of these injuries, the different types of treatment advocated by observers and the lack of uniformity in the results obtained give evidence of the possible value of further investigation. Over and above these considerations these fractures are of interest because of their importance to the patients, entailing, as they not infrequently do, permanently disabling injury to the elbow-joint.

The fifty cases which are the subject of this report have been gathered from the records of the Roosevelt Hospital and its Out-patient Department covering a period of ten years. They represent all of the instances of fractures of the head and neck of the radius which could be found during this period, with the exception of four, in which the records were not sufficiently complete to be of value.

Incidence—The fractures in this group were nearly evenly divided between the sexes. Twenty-seven of the patients were males and twenty-three females. Study of the age incidence bore out the statements of Rabourdin¹ and other observers that these injuries are more common in adults and young adults than in children. The average age of the patients was 31. The oldest was 55, while the youngest was 6. The preponderance of adults may perhaps be better indicated by the statement that 28 of the patients were thirty years of



FIG. 1.—Example of Class I. Simple crack in the radial head.

* Read before the Surgical Section of the New York Academy of Medicine, October, 1925.

age or older, while but 12 were under twenty. A further distinction, with respect to age, should be made in considering the fractures of the neck of the radius. Here, as emphasized by Speed,² the younger ages predominated, with an average of 18 years. Eliminating this group raises the average age for fractures of the head to 37 years, which places these injuries still more definitely in the adult category.

Etiology—Considering this group of fractures of the upper radius with respect to the nature of the injury producing them, it was found that 20, or 40 per cent, had been caused by falls on the elbow. Four (8 per cent) were



FIG. 2—Example of Class 1. Simple crack in the radial head.



FIG. 3—Example of Class 2. Fracture of the radius with separation of one fragment.

reported as following falls in which the forearm received the impact. Four were due to twisting injuries of the forearm, while falls upon the extended hand accounted for 10, or 20 per cent. In twelve the nature of the trauma was not reported. If the histories of these injuries are to be accepted as accurate, the findings in this group rather seem to support the views of Stimson³ and of Raboultin,¹ who mention direct trauma as the most frequent cause of this type of fracture, while Scudder⁴ speaks of falls on the hand as being most commonly responsible.

Pathology—In reviewing these cases with regard to their pathology they were found to group themselves most readily into four main classes. The least severe injury was the simple crack in the head of the radius without displacement of the fragment. Of these there were seven. The second class

FRACTURES OF HEAD AND NECK OF RADIUS

comprised those cases, fourteen in number, in which there was a fissuring of the radial head with separation of one fragment. In the third class were grouped eleven cases in which the head was fragmented or split into two or more separated pieces. Fractures of the neck of the radius, of which there were fourteen, made up the fourth class. In four cases the exact pathology could not be ascertained.

Although it is well recognized that the patient is not likely to remember or report accurately the manner of receiving his injury, an attempt was made to secure as exact a history as possible on this point. It was hoped that an



FIG. 4 —Example of Class 2. Fracture of the head of the radius with separation of one fragment.



FIG. 5 —Example of Class 3. Fragmentation of the head of the radius.

attempt to show the relation of the nature of the trauma to the pathology might throw some light upon the mechanism of production in these fractures. The results were as follows:

<i>Type of Injury</i>		<i>Nature of Trauma</i>				
		Striking elbow	Fall on hand	Twist of forearm	Fall on forearm	Un- known
1 Crack in radial head	(7)	3	1		3	
2 Separation of one fragment	(14)	7	3	1	2	1
3 Fragmentation	(11)	2	2	2	1	4
4 Fracture of neck	(14)	6	5			3

From the above tabulation it would appear

1 That direct trauma was more frequently the causative injury in simple crack of the radial head.

2 That separation of one fragment occurred relatively frequently from direct trauma. The single fragment was fractured from the anterior lip in eight of the fourteen cases.

It is suggested that this chipping of the anterior lip may be caused by falls in which the forearm lies beneath the body in mid-pronation. In this situation the force of the blow striking the lateral aspect of the radial head, may be transmitted across the head of the radius against its area of firm contact with the lesser sigmoid cavity of the ulna, resulting in cracking off the anterior part of the head.



FIG. 6—Example of Class 3. Fragmentation of the head of the radius.

3 That in fragmentation of the head, each of the usual accidents played about an equal part. Of four cases where wide separation occurred with apparent rupture of the orbicular ligament, two were caused by falls on the extended hand and two by twisting injuries of the forearm.

4 That direct and indirect violence were about equally responsible for fractures of the neck of the radius. Of the eight children under sixteen years of age who suffered this injury in the present series, four each were ascribed to direct and to indirect trauma.

A certain relation is suggested here between the fact that fractures of the neck of the radius are more common in children and the

observation that direct trauma is so frequently the cause of this injury. It seems reasonable to suppose that in children a fall on the extended hand is more likely to cause injury at the line of least resistance above the humeral condyles than in the upper radius. In the adult the head of the radius, no longer partly cartilaginous but inelastic, cancellous and with a relatively thin shell of cortex, is more likely to be split or shattered by the upward thrust against the capitellum resulting from indirect trauma. Thus, while indirect violence seems more likely to cause radial head injuries in adults than in children, direct violence remains a competent cause of fractures of the upper radius in both.

Review of the above analysis of pathology with reference to character of injury would seem to indicate that it is impossible to predicate the type of lesion definitely from the history of the trauma. Direct and indirect trauma

FRACTURES OF HEAD AND NECK OF RADIUS

were apparently capable of producing any of the four classes of fracture. Twisting injuries of the forearm, or falls with the forearm twisted, probably involving the element of forced abduction, appeared as causative factors in two of the classes in this group, namely those in which there was separation of one or more fragments of the head. It was of interest to note also, that in the more severe injuries (fragmentation of the head and fracture of the neck

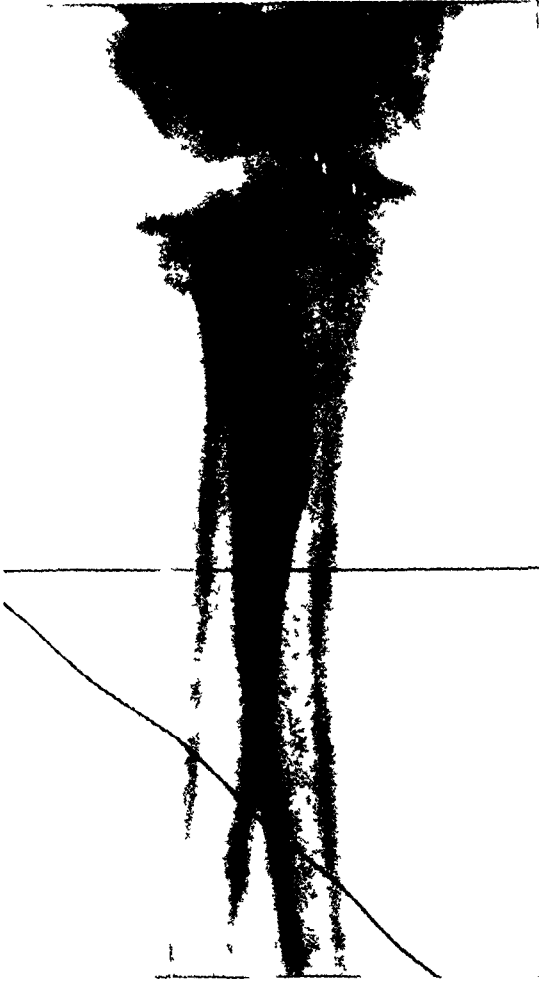


FIG 7—Example of Class 4. Transverse fracture of the neck of the radius

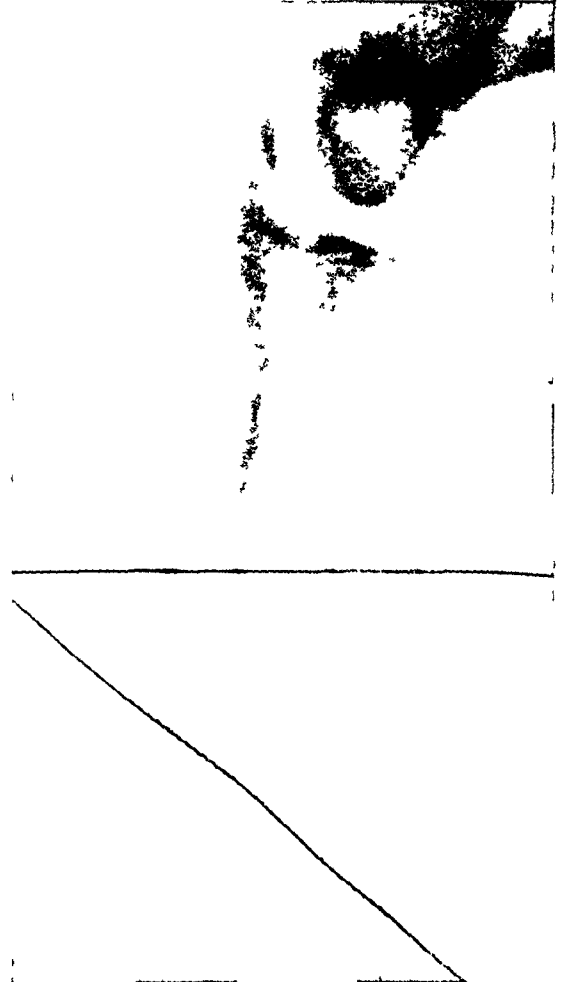


FIG 8—Example of Class 4. Transverse fracture of the neck of the radius

with marked displacement) the ratio of indirect to direct trauma was greater than in the less severe cases.

Complications—The fact that falls on the extended hand and twists of the forearm are likely to be productive of the more serious damage is further indicated by the complications which occurred in this group. Of these there were six. Two were posterior dislocations of the ulna with fracture of the neck of the radius, due to falls on the hand. One was a compound dislocation of the ulna with fragmentation of the radial head from a twist of the arm. One was a posterior dislocation with fracture of the olecranon and transverse separation of the head from a fall on the elbow. One was a fracture of the coronoid with an anterior chip broken from the head of the radius due to a fall from a height. In this case a fracture of the skull further complicated the picture,

and a definite history of the mechanism was not obtainable. The remaining case, a fracture of the neck of the radius, was complicated by a fracture of the upper third of the ulna in a young child. Here also the history of the injury was not satisfactorily elicited.

Symptoms and Signs—The symptoms and signs presented by these injuries of the upper radius showed a considerable degree of uniformity. Pain, referred to the elbow region, particularly at the outer side, was complained of in all cases except four. These four came for the relief of a disability result-



FIG 9—Transverse fracture of neck of radius in child of eight. Picture taken three years after complete removal of radial head. Complete restoration of function shows enlargement of lesser sigmoid to form new radio ulnar articulation. This case was complicated by fracture of upper third of ulna. (Case R. L. No. 1441.)



FIG 10—Transverse fracture of neck of radius in child of eight. Picture taken three years after complete removal of radial head. Complete restoration of function shows enlargement of lesser sigmoid to form new radio ulnar articulation. This case was complicated by fracture of upper third of ulna. (Case R. L. No. 1441.)

ing from injury some time previously. Disability was a uniform complaint, having been noted in all the cases of the group, both recent and old. This disability involved characteristically all motions at the elbow, flexion and extension as well as pronation and supination, varying somewhat in degree according to the severity of the injury. In the few cases in which it was noted, the attitude assumed by the patient was that of mid-flexion of the elbow, with the arm supported. Swelling, in the cases seen within twenty-four hours after injury, occurred in about two-thirds of the patients and was noted as being usually diffuse about the elbow.

Ecchymosis was less common, being observed in but nine of twenty-two recent cases. Bony irregularity was noted in but four of the cases seen soon after injury. Each of the four had suffered transverse separation of the head from the shaft with rather marked displacement. With the exception of the four old cases mentioned as applying for relief of disability, and the one of compound fracture-dislocation, all of the cases of the group showed tenderness. Direct and indirect tenderness were present together in forty-three instances. Direct tenderness, over the head of the radius proved to be the most reliable of all the signs, appearing as the only localizing evidence in three of the cases observed. Failure of the head to rotate with the shaft was noted in two cases of fractures of the neck. No observation was made, or at least none was recorded, of the presence of abnormal lateral mobility, one of the physical signs mentioned by Stimson.³

Diagnosis—In view of these findings the diagnosis of a typical case of fracture of the head of the radius rests upon a history of a fall on the hand or the elbow, or a twisting injury of the forearm, followed by pain about the elbow, limitation of supination and pronation as well as flexion and extension, showing some swelling about the elbow, referring indirect tenderness to the region of the radial head and with direct tenderness elicited in the same region. If, in addition, failure of the head to rotate with the shaft can be demonstrated, or if bony irregularity of the head varying from its normal relations can be felt, separation of the head may be diagnosed. The X-ray picture is confirmatory. Emphasis should be laid upon the necessity of making the exposures in two directions. If this is not done a number of cases in which the head is merely cracked will fail of proper diagnosis.

The X-ray findings in the cases of this group have been indicated in the discussion of the pathology. In general they showed a considerable variety in the injuries sustained, even in each of the four main classes into which the group has been divided. For example, in the class of crack in the radial head with displacement of the fragment, several of the cases showed but slight



FIG. 11.—Fragmentation of the head of the radius in boy of twelve. Treated by removal of fragments. Picture shows condition three years after operation. Exostoses and bony proliferation marked. Slight limitation of flexion and pronation. (Case H. No. 1442.)

displacement of the separated piece, while in one instance (as proved at operation) the fragment lay in the flexor muscles completely outside the joint. Similar variations in degree of fragmentation and amount of displacement of the radial head occurred in classes three and four, respectively. But one case of impacted fracture of the neck was observed, although Thomas⁵ mentions this injury as being frequent. Another point of interest was noted, in that, although there were eight cases of separation of the radial head in children, only two were epiphyseal separations, the others being frank fractures of the neck, distal to the epiphyseal line.



FIG. 12.—Fragmentation of the head of the radius in boy twelve. Treated by removal of fragments. Picture shows condition three years after operation. Exostoses and bony proliferation marked. Slight limitation of flexion and pronation. (Case H, No. 1442.)

Prognosis—Considering the variations in pathology observed it is obviously difficult to lay down a general rule of prognosis for the composite group of fractures of this type. The prognosis in each case must take into account such factors as the type and extent of the fracture, the presence or absence of complications, the age of the patient and the method of treatment employed. Study of this particular group of cases indicates that the best results may be expected in the less severe injuries where the head is merely cracked or where one fragment is displaced, while in fragmentation and fracture of the neck, particularly where there is much displacement, the prognosis is less favorable. Where the picture is further complicated by the presence of other fractures in the

region or by dislocation, the prognosis is least favorable. Here, as in other types of fracture, the younger ages offer the better prospect of satisfactory recovery. As important as any of these factors in determining prognosis is the question of treatment. Scudder⁴ emphasizes this in saying that with proper treatment uncomplicated fractures of the head or neck of the radius should result in union and normal function.

Treatment—Yet as to what constitutes proper treatment in these cases the opinions of the various writers differ. Scudder⁴ takes the somewhat conservative view that fractures without much displacement are amenable to treatment by immobilization in right angle position until union occurs, followed by mobilization. Where the fragments are widely separated, or where non-

FRACTURES OF HEAD AND NECK OF RADIUS

union, adhesions, callus, or displaced fragments impair the usefulness of the arm he advocates operation. Mouchet,⁶ referring particularly to fractures of the neck, feels that immediate movement and massage is indicated without attempt at reduction. Rabourdin,¹ on the other hand, feels that non-operative treatment is only applicable in cases where there is a fissure of the radial head, and advocates the removal of fragments and an early cleaning of the joint in all others. Jones¹¹ recommends excision when the head is displaced with fracture, and when supination cannot be obtained. Hitzrot⁷ cites 13 of 15 cases which, without operation, showed loss of one-half the normal rotation, while Thomas⁸ mentions 12 of 18 unoperated cases which showed ankylosis, non-union, or impaired function. Estes⁹ states it as his opinion that resection is too seldom practiced, while Wilson and Cochrane¹⁰ believe that the end results are often surprisingly good without operation, and recommend the closed method of treatment as best in dealing with cases which show either only slight displacement, or extensive comminution.

In the group of cases under consideration the treatments used in the various classes were as follows. All of the seven cases of simple crack in the radial head were treated by the closed method. Of those showing displacement of one fragment of the head six had operative treatment and eight did not. In eight of those with fragmentation the fragments were

removed, while three were not operated upon. The radial head was removed in eight of the cases with separation of the head, while no operation was performed in six. Four of the cases in which operation was done were old cases in which much limitation of motion was present. One of these showed much callus and practically ankylosis following marked fragmentation of the head, while the other three were complicated by dislocation of the ulna. Eighteen of the unoperated cases were treated by placing the arm in supination and acute flexion for from five to twelve days, followed by the use of sling and baking and massage, active and passive motion. The remainder were treated



FIG 13.—Case Lu No. 8468. Fragmentation of the head of the radius in a boy of nine. Immobilization in flexion for ten days, followed by sling and baking and massage.

with rest in a sling from the start Reduction of a displaced fragment (separated head with forward displacement) was attempted twice, once with success

It is felt that the treatment of these conditions in the flexion position with supination (where the closed method is used) has certain advantages In general, the ability to secure flexion and supination indicates that the fragments are in such position as to permit of this range of motion, and that they may be retained there, with at least the possibility of union Also, as in other

fractures of the elbow, this position obtains the early restoration of these important motions, which otherwise are often difficult to regain In the class of radial head fractures with a simple crack, this advantage is sufficient to warrant the use of the method In fragmentation or separation of the head the failure of an attempt to secure this position by reason of bony interference may well be the indication for excision of the fragments, as full and useful function of the arm is not then otherwise obtainable If flexion and supination can be secured, union and restoration of function are possible

Results—In tabulating the results of treatment in the cases of this series the following criteria are used Good—complete restoration of function, Fair—slight limitation of one or more motion, Poor—marked limitation of one or more motion The

FIG 14—Case Lu No 8468 Fragmentation of the head of the radius of a boy of nine Immobilization in flexion for ten days followed by sling and baking and massage

early results, noted at the time of discharge or of cessation of treatment, were as follows

Class of Injury	Excision			Non-operative		
	Good	Fair	Poor	Good	Fair	Poor
1 Crack in the radial head				5	2	
2 Separation of one fragment	2	3	1	4	3	
3 Fragmentation	2	6		1	2	
4 Fracture of the neck	1	5	2	3	2	1

The report of late results, secured by examining the patients a year or more after discharge, is less complete, but indicates in a general way what may be expected in the treatment of these injuries

FRACTURES OF HEAD AND NECK OF RADIUS

<i>Class of Injury</i>	<i>Excision</i>			<i>Non-operative</i>		
	Good	Fair	Poor	Good	Fair	Poor
1 Crack in the radial head				5	1	
2 Separation of one fragment	5	1		2		
3 Fragmentation	3			1		
4 Fracture of the neck	3	2		5	1	

Upon the basis of these results alone it would be manifestly impossible to make a satisfactory comparison between the operative and non-operative methods of treating fractures of the head and neck of the radius. The figures



FIG 15 —Result in case shown in Figs 13 and 14 FIG 16 —Result in case shown in Figs 13 and 14

do indicate, however, that the closed method of treating simple cracks of the radial head produces satisfactory results. As regards fractures of the other three classes it can only be said that each method has yielded some results that were good, as well as a few that were imperfect. It would seem, therefore, unwise to advocate excision in every case of fragmentation or fractured neck. This is especially true since the operative procedure itself is not free from danger. The technical difficulty of locating and removing a single displaced piece of the head, or of finding and extracting all pieces in a multiple fragmentation may be considerable. In one case of this group, at least, not all of the fragments could be extracted. In addition, three of the cases operated upon suffered infection of the wounds, resulting in delayed convalescence and in impaired results in two. Considering also the fact that should the closed method fail of good results in appropriate cases recourse may still be had to

CONDUCT W CUTLER

surgical removal of the fragments, it would seem best to treat these injuries without operation except where definite indications for removal are present. Such indications would appear to be 1 Such displacement of a fragment or of the whole head as would interfere with full joint motion 2 Irreducible complicating dislocation of the radius or ulna or both 3 Mal-union, ankylosis or impaired motion in old cases

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LATE RESULTS IN TREATMENT OF SIMPLE FRACTURE OF THE FEMUR IN ADULTS *

By RODERICK V. GRACE, M.D.
OF NEW YORK, N.Y.

THE numerous papers now appearing in the literature regarding fracture of the femur in adults, indicate the renewed interest in this subject as well as a marked diversity of opinion regarding the methods of treatment to be used. In this analysis of cases treated in the First Surgical Division of Bellevue Hospital no attempt is made to recommend any standard method of treatment, but by a critical review to ascertain the strength and weakness of our present methods of care so that we may approach the best anatomical and functional results in the highest per cent. of cases, and at the same time shorten the time of disability. This analysis deals with the treatment of 47 patients, all adult cases.

Age 15-20 years, 5 cases, or 10+%

40-50 years, 11 cases, or 23%

20-30 years, 13 cases, or 27%

50-60 years, 8 cases, or 17%

30-40 years, 8 cases, or 17%

60-70 years, 2 cases, or 5%

Sex 34 males 13 females

Site of fracture Upper third, 14 cases Middle third, 23 cases Lower third, 10 cases

In this analysis no case has been considered in whom the follow-up was less than one year.

The patients are grouped according to the methods used, into two general classes. A Operative cases, 12 B Non-operative cases, 35. This latter group is subdivided into cases treated by 1 Skin traction 2 Skeletal or caliper traction 3 Plaster case.

Operative Group—The indications for these operations may be grouped under two heads: 1 Failure of reduction 2 Non-union.

Failure of reduction, eleven cases, reasons for: a Tissue interposition, 2 cases b Skin traction failure to overcome overriding, 9 cases.

In these last skin traction failures the patient showed by X-ray and actual measurement, overriding varying from 4 to 8 cm. One must be struck by the fact that in only two cases of this series, many of them very severe fractures, was tissue interposition present as a bar to satisfactory reduction. The larger group of 9 cases in which reduction failed after skin traction shows the limitations of this device, especially in cases in which the overriding is more than 4 cm.

Results of operative methods: operative failure, one death (anæsthetic), one amputation for streptococcus hæmolyticus infection, one non-union.

In the remaining 8 cases an excellent anatomical and functional result was obtained. These cases showed bony union occurring in from six to eight

* Read before the New York Surgical Society, October 28, 1925.

weeks The shortest time of disability was three months, the longest time was ten months and the average time was six and one-half months

Out of 9 plated cases, it was necessary to remove the plates in 4 In two of them, pain was the persistent symptom which caused the patient much distress It was relieved by removing the plate At operation in each of these cases there was some evidence of loosening of the screws and plates The removal of the plates was followed by healing without incident In the third and fourth cases the plate was removed on account of non-union at the site of fracture

A résumé of the three operative failures follows

CASE I—J W fifty-nine, male, lower third Twenty-four hours after admission calipers applied, 20 pounds The 3 cm overriding was overcome, but lower fragment still remained displaced backward Two efforts were made under general anesthesia ether, to reduce without success During this period, five X-rays were taken within thirteen days, when an open reduction was done

Operation—Open reduction, Lane plate

Pathology—Cause of failure was tissue interposition

Post-operative Course—Wound healed per primum In three months he showed firm union with a large callus and perfect position Follow-up six months, a large callus and firm union Flexion to 75°, extension 180°

Follow-up one year He complained of pain in fracture and gradual increasing disability Readmitted 15 months after first operation Operation Removal of Lane plate The outer plate was fractured The screws were loose Fibrous union was present, but there was slight abnormal mobility The callus was very large, the deep tissues were unhealthy looking Uninterrupted recovery followed On account of the slight abnormal mobility, Thomas caliper splint was applied Since this time up to the present, the patient has shown increasing abnormal mobility at site of fracture The function at the knee is very good It is necessary for him to walk with a Thomas splint which prevents abnormal mobility at his fracture It is impossible for me to say why this patient should have developed non-union after such a long period of time Wassermann reaction was repeatedly negative

CASE II—H S, thirty-seven, male, site of fracture, middle third Patient was admitted eight days after fracture which was transverse with 5 cm overriding Twenty-pound calipers applied and overriding overcome in twenty-four hours There was over-separation of about 1 cm Therefore weight was reduced Five weeks later, there was no evidence of union therefore open operation was done and Lane plating

Gross Pathology—The fracture ends were eburnated There was no evidence of callus formation The medullary cavity was not obliterated, the bone ends lay in the middle of a large cyst with smooth lining containing about one and one-half pints of bloody fluid The crureus muscle was lacerated and degenerated

Microscopic Pathology—Specimen shows muscle, dense connective tissue and hemorrhage The connective tissue is lined on one side with flat connective-tissue cells This is evidently the inner surface of the cyst The section shows slight round-cell infiltration

Course—Wound healed per primum At end of second month, plate appeared loose There was union present, but it was not very firm A second operation, two months after plating was done and Lane plate removed A moderate amount of callus was found to be present but there was slight mobility at the site of fracture The wound healing was complicated by presence of a hematoma microscopically, there were pus cells present in smear of the wound The culture showed staphylococcus aureus The wound healed by granulations in four weeks Two Wassermans taken at this time were negative Three and one-half months after this there was apparently firm union and no mobility

RESULTS OF FRACTURE OF FEMUR IN ADULTS

Patient wore a Thomas caliper splint. Follow-up six months later, no union. Re-admitted for third operation, namely, bone transplant. Third operation transplant graft inlay. Patient developed a severe streptococcus hæmolytic infection locally. Amputation was necessary. He had three transfusions, recovery followed. Specimen at operation showed dense scar tissue. There was no evidence of bone formation. In one area there was a small amount of calcium salt present.

Comment—In five weeks following admission, patient had six X-rays. In eight weeks, following first operation, he had four X-rays, and in the two following months two more X-rays. This with failure of immobilization before admission to the hospital may have been factors in preventing bony union.

CASE III—Open reduction for transverse fracture of middle third. Patient died on table. Death probably due to anæsthesia during operation.

Comment—These results, even though of a small series, bring out the advantages and disadvantages of open operation. The excellent anatomic and functional result when obtained shorten the time of disability greatly. With the increasing success in the treatment of fractures of this type by calipers, the number of open operations has been considerably diminished and will probably be limited mostly to those cases in which reduction is prevented by tissue interposition and in cases showing mal or non-union.

Skin Traction Cases—This was the earlier and more conservative method of traction suspension used. Adhesive was the material in all the cases, 23 in number. Ten cases, or 43 per cent, were successfully treated by this method alone. In 13 cases, or 57 per cent, this method was found to be a failure, and reduction was obtained either by skeletal traction or open operation. In skin traction, the weights applied vary from 15 to 25 pounds. In the 10 successful cases, 6 showed 2 cm overriding or less, 3 showed 3 cm overriding or less, and 1 showed 4 cm overriding. In only two of these 10 cases was the overriding reduced by more than 2 cm. In the remaining 8 cases, there was very little change in the measurements after a reasonable period for reduction had elapsed. In these successful cases, bony union occurred from seven to ten weeks, the average being eight and one-half weeks. The disability ranged from six to thirteen months, the average being eight months plus. The average overriding in these cases on discharge was 2.5 cm. In the thirteen unsuccessful cases, the reason for the substitution of another method was the failure to reduce the overriding to less than 3 cm. In one case, the adhesive irritated the skin so badly that it had to be removed and a plaster case substituted. Of the remaining 12 cases eight were treated by open reduction and four by the insertion of calipers. The objections to the method of skin traction are patent in view of the fact that usually the amount of shortening which a patient can have and obtain a satisfactory functional result, without limping is 2.5 cm. It is necessary that the overriding be reduced to at least this amount and since this is not usually accomplished, it restricts the use of skin traction to that smaller group in which the fragments are in good position and the overriding less than 2.5 cm, presuming the skin can bear the adhesive material.

In the unsuccessful cases treated by skin traction, the larger number were brought to a successful result by open reduction. This was at a time when

our experience with calipers was limited. With our knowledge and experience in the use of calipers we now feel that this latter method would have sufficed in many of these cases and have been the method of choice.

Caliper or Skeletal Traction—This more recent method of treatment we think to be the method of choice in the majority of cases. The theoretical objections offered against this method are (1) Anatomic misplacement into joint, epiphysis or neighboring soft parts. With reasonable care and experience, misplacement should rarely happen. In our series each of these misplacements has occurred. They were quickly recognized and reintroduction of the tongs effected without any disability. (2) Wound infection. This will be discussed later.

The advantages claimed for this method of treatment are

(1) It overcomes overriding in all cases quickly unless there is tissue interposition and tends toward anatomic reposition of the fractured ends.

(2) It allows massage and motion during the time of traction, thus diminishing the muscle atrophy and stiffness of the adjacent joints.

(3) It promotes the comfort of the patient.

(4) There is a relative ease of care of the fracture after application.

(5) It serves to correct the displacements of fractures during the course of their repair up to the time of bony union.

The calipers used are of the dull type. Under local anesthesia they are inserted slightly into the femur just behind the condyles. The traction weights are immediately attached. The position of the calipers is checked up by X-rays.

Caliper Traction—Caliper traction, number of cases, 18. In 4 of these it followed failure of skin traction to overcome overriding. In the remainder it was used primarily. There were two misplacements, both of which were recognized by X-rays. In one case a caliper point was placed at the epiphyseal line. In another case a caliper point becoming loose, slipped into the joint. No untoward results followed correction of these misplacements.

Overriding—The average in these cases varied from 4 to 8 cm. In only one case did caliper traction fail to bring the bony ends into a position judged to be satisfactory. Operation later showed this failure to be due to tissue interposition. Therefore, having this complication, in our experience this has been the most successful method of overcoming even the most extreme overriding. The weight applied varies from 15 to 25 pounds in the majority of cases. This will as a rule cause a satisfactory reduction. The check-up X-ray should not be taken before 48 to 72 hours has elapsed. In a few cases, overweighting may result in separation of the fragments. This overseparation if allowed to continue may be a factor in the delayed or non-union cases. Bony union occurred in all but two cases, one of these showed muscle interposition at open operation. The other showed non-union five weeks after admission with eburnated bones lying in a cyst. Bony union occurred on an average of eight weeks. The average time of disability was nine and one-half months. Follow-up results on these patients show that in all but four cases there was

RESULTS OF FRACTURE OF FEMUR IN ADULTS

a satisfactory anatomic and functional result. Of the other four cases the anatomic result was good, but there was either slight limp present or the function was restricted to 90° of flexion.

Wound Healing—Many of the wounds showed marked local inflammation. This probably involved soft parts and periosteum with cortex to a lesser extent. In several cases, cultures of inflamed wounds showed the presence of staphylococcus aureus. The inflammation usually subsides with the withdrawal of the calipers. The average time for the wounds to heal was two to four weeks after removal of the calipers. The temperature varied from normal to $100\frac{1}{2}^{\circ}$ during time of caliper traction. Some of the cases, however, show no febrile reaction. The inflammation is generally superficial in the bone, if it should be present there.

In one case the patient showed a sinus which persisted for five months and then healed. In another case the patient, after discharge, was subjected to curetting of the bone at another hospital. This temporarily lighted up his wound.

The sinus failed to heal until eighteen months had elapsed when patient discharged a small sequestrum. Redness and swelling of the soft parts is no indication for the removal of calipers. These local signs are purely temporary. The spreading of the infection and persistent pain with a positive wound culture necessitates their removal. During this method of treatment the care of the muscles and adjacent joints can be very efficiently carried out. With the adjustable knee piece attached, early motion may be instituted, and thus the extreme stiffness of adjacent joints may be obviated. In several cases seen by us, severe overriding has been overcome as late as the eighth week. In this type of case, X-ray has even showed large amount of callus present at the fracture site. In such cases, weights may be steadily increased within reason, until the overriding is overcome. As an extreme example, a weight of 60 pounds was used on one of these patients for a short duration, which overcame overriding of 6 cm., after which the weight was immediately reduced.

The relative comfort of these patients in moving about in bed and the ease in their nursing care are also factors that recommend this form of treatment. Old age is no contra-indication. Several patients close to seventy years have been treated by this method. We believe the principle of skeletal traction to be a sound one. The unsuccessful results that are mentioned after its use do not alter the worth of this principle.

Plaster case, 6 cases. Of these two refused traction and plaster case was applied. One had also fracture of both bones of leg. One had also fracture of pelvis. Two had transverse fracture with no displacement. The average disability was eleven months, the shortest was six months and the longest eighteen months. The relatively small number of cases treated by this method make conclusions hazardous.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY

Stated Meeting Held October 28, 1925

The Vice-president, DR FRANK S MATHEWS, in the Chair

TRAUMATIC RUPTURE OF HYDRONEPHROTIC KIDNEY

DR DE WITT STETTEN presented a boy, age nine years, who was seen by him about noon of March 27, 1925, with a history of having been struck in the lower abdomen, on the back and thigh. He immediately afterwards complained of severe pain, but did not vomit or void. The point of interest in the past history is that the child since the age of one and a half years had had frequent attacks of abdominal pain with vomiting. This pain was referred largely to the right upper abdomen. These attacks usually lasted about two days, during which time there was rather severe pain, and then for the following week there would be slight abdominal discomfort. During these attacks there was never fever nor any urinary symptoms. These attacks were variously diagnosed as cholecystitis and appendicitis. They have been less frequent in the past few years, the last having been seven months before the present illness.

When seen the child was very irritable, but had a good color and did not look collapsed. Pulse was 60. He was lying with his thighs drawn up on his abdomen. There was distinct sensitiveness and some rigidity in the right upper quadrant, but not elsewhere in the abdomen. The following day patient seemed quieter but had begun to vomit and was passing somewhat bloody urine. The vomiting was rather continuous and each specimen of urine seemed to be a little more bloody than the last. Patient then became slightly drowsy and the pulse and temperature began to rise a trifle. About thirty hours after the injury the temperature was 101°, pulse 116. The last urine passed was very bloody. There was definite sensitiveness and rigidity in the right hypochondrium and in the entire lower abdomen but no evidence of a mass or urinary extravasation. On the suspicion that he was suffering from either a rupture of the right kidney or of the bladder, he was admitted to the Lenox Hill Hospital. A cystoscopy showed a profuse bleeding from the right ureteral orifice, with clear urine coming from the left ureteral orifice and no evidence of bladder injury. With a provisional diagnosis of traumatic rupture of the right kidney following a blow on the abdomen, about thirty-five hours after the injury through a right Mayo incision the perirenal space was opened. This was found filled with at least one pint of clotted blood and extravasated urine. The right kidney was a typical hydronephrotic organ with a much dilated pelvis and calyces. A fibrous strand probably containing a vessel ran between the pelvis and ureter, producing a kink at the point of junction. The ureter was somewhat thickened and friable. On the anterior surface of the dilated pelvis was an irregular jagged tear about one and a half inches in length running up into the kidney substance. From the edges of the tear, especially where this extended into the kidney, there was marked oozing. A typical nephrectomy was done, including about two inches of the ureter below the pelvis.

EXTRAMEDULLARY TUMOR OF SPINAL CORD

The specimen presented a typical hydronephrotic kidney with a markedly dilated pelvis and calyces and a very thin cortex varying in thickness from $\frac{1}{4}$ to $\frac{3}{8}$ inch. The wall of the pelvis was somewhat thickened and the ureter was also somewhat thickened, dilated and rather friable. There was definite kinking at the junction of the pelvis and ureter. There was no gross evidence of tuberculosis. There was an irregular jagged tear about one and a half inches in length on the anterior aspect of the dilated pelvis running into the kidney substance. Microscopical examination showed the typical lesions of hydronephrosis with no evidence of tuberculosis.

Patient's convalescence was entirely uneventful. Since the operation he has gained seven pounds in weight and has had no recurrence of his attacks of right-sided abdominal pain.

An analysis of this case justifies the opinion that this boy suffered from a congenital hydronephrosis due to an anomalous vascular strand producing a kink at the junction of the pelvis and ureter, and that his previous abdominal attacks were due to an over-distention of the hydronephrotic kidney. It is fair to assume that there was moderate distention at the time of his accident, so that a relatively slight trauma was capable of producing the rupture.

EXTRAMEDULLARY TUMOR OF SPINAL CORD SIMULATING ABDOMINAL MALIGNANCY

DR DE WILF STETTEN presented a man, age forty-four years, who was first seen on February 3, 1922. He gave a history of an old, thoroughly treated lues acquired about twenty-five years ago. His wife has no children, but had two miscarriages at about four months. In January, 1921, he had an attack of what was diagnosed as sleeping sickness and was in bed seven weeks. His present illness began six months ago with a persistent deep pain in the right hypochondrium radiating to the back. He believed he was jaundiced and vomited occasionally. He lost thirty-five pounds in weight. His main difficulty was that he could not lie down and had practically not been in bed during the entire period. He slept fitfully in a chair or standing in a corner. His bowels were constipated but there was no difficulty in micturition. There was a complete loss of sexual power. The pain was so severe that he was forced to take morphine which he is now using in large doses. A thorough X-ray examination of his genito-urinary tract, including cystoscopy and catheterization of the ureters, was negative. A complete gastro-intestinal series showed some cæcal obstruction with adhesions around the appendix and cæcum, but was otherwise negative. The blood Wassermann was negative, but an examination of the spinal fluid in November, 1921, showed a 4 plus Wassermann with 10 to 11 lymphocytes to the field and a marked excess of globulin on the basis of which an intraspinal and an intravenous salvarsan treatment were given.

The patient was admitted to the Lenox Hill Hospital on February 7, 1922 and on examination showed very little. He was haggard in appearance. His color was sallow, almost subicteric. There was some superficial sensitiveness in the right hypochondrium but no rigidity or mass. The most striking sign was a definite and marked rigidity of the dorso-lumbar spine. The pupils reacted to light and accommodation. The knee-jerks were lively. There was no sensory or motor disturbance. Heart, lungs and temperature were normal. An X-ray examination of the entire spinal column, heart and lungs showed a slight productive arthritis involving the anterior edges of the bodies of the upper dorsal vertebræ. There was a considerable enlargement of the thoracic aorta with distinct increase in density of the walls of the artery,

suggesting a specific aortitis and most of the anterior costal cartilages were ossified. Further spinal puncture was refused because of unpleasant effects previously experienced and was not urged, because of the patient's serious condition and because it was felt that little information could be gained therefrom.

After several consultations a provisional diagnosis of a lower thoracic posterior radiculitis, probably of luetic origin was made, and an intense course of antiluetic treatment instituted. This was continued for about six weeks without improvement. Although there were slight remissions the pain was still very severe, to alleviate which, larger doses of morphine were required. Lying down was practically impossible. He continued to lose weight rapidly, so that his total loss since the beginning of his illness was approximately sixty pounds.

On March 24 for the first time signs of a level lesion of the spinal cord were noted by Dr. O. Hensel in the form of a band of hyperæsthesia, about two inches in width, extending around the body about the level of the umbilicus. A further neurological examination at this time revealed that there was a left Babinski and a left ankle clonus and that all the deep reflexes of the lower extremity were exaggerated. The lower abdominal and cremasteric reflexes were absent. There was no marked disturbance in motor power, or of thermal, pain, tactile, muscle or articular sense, but a very definite loss of vibratory sense from the anterior superior spine down especially left. In addition, the patient had difficulty in voiding and occasional catheterization was necessary. Unless under the influence of morphine he had an agonized expression and seemed in excruciating pain. Some œdema of the legs, especially at the ankles, had also developed. The patient actually looked cadaverous and gave the impression of being in a state of advanced cachexia. The diagnosis now was comparatively simple and the patient was examined repeatedly in order to more accurately localize the exact level of the lesion. With the assistance of Doctors Elsberg, Kennedy and Goodhart the lesion was finally located at about the tenth to the twelfth thoracic segments involving both sides rather equally, but probably more on the right, and operation decided upon with the definite diagnosis of tumor of the spinal cord. The possibility of a malignant type of growth was seriously considered owing to the advanced cachexia of the patient.

April 11, 1922, under general anæsthesia, a curved incision was made with convexity to the left and including the seventh, eighth, ninth, tenth, eleventh and twelfth dorsal spines. The spinous processes and laminae were exposed. The eighth to eleventh spines inclusive and the corresponding laminae arches were removed. Pulsation of the dura was apparently normal. On closer inspection, however, at the lower angle of the wound, a white spot was noticed over which the dura bulged slightly. The dura was opened at a point corresponding to this bulge and a definite extramedullary tumor was observed lying on the posterior aspect of the cord extending downward from a little above the eleventh arch. The growth lay a trifle to the right. It was found necessary now to remove the twelfth dorsal spine and laminae and the dural incision was extended downward to below the lower limits of the growth, which ended approximately at the upper edge of the twelfth arch, the lesion being located several segments below the point anticipated. The tumor was a fair-sized ovoid growth about the size and shape of a small olive (Fig 1). It was distinctly encapsulated and was easily shelled out without any damage to the cord and with only very slight oozing, which was readily controlled by hot saline wipes. A posterior root fibre on the left side ran through the growth and was divided. One bleeding point in the pia

EXTRAMEDULLARY TUMOR OF SPINAL CORD

was clamped and ligated. After hæmostasis was complete, the dura was sutured with a fine continuous silk suture.

The tumor was an irregular ovoid growth measuring $1\frac{1}{8}$ inches in length, $\frac{5}{8}$ inch in width and $\frac{1}{2}$ inch in thickness. It had a distinct but thin capsule. The upper pole was somewhat larger than the lower and slightly lobulated. In color it was light reddish and in consistency it was rather soft. Microscopical examination (Doctor Bullock) showed the tumor to be a somewhat cellular neurofibroma or possibly a neurofibrosarcoma, probably quite benign in character.

The convalescence of the patient was entirely uneventful, the wound healing by primary union. Within twenty-four hours the patient voided spontaneously and the pains gradually subsided, although a slight subjective pain with a corresponding small area of hyperæsthesia in the right hypochondriac region persisted for some time. For a few days he complained of a subjective feeling of

numbness in the lower extremities, although no marked sensory or motor disturbance could be elicited. Eight days after operation the left cremasteric reflex reappeared and about the same time morphine was discontinued. Patient was out of bed twelve days after operation and one week later began to walk without much difficulty. At this time it was noted that the left Babinski had disappeared, that the kneejerks were less active, that both cremasteric reflexes had reappeared and that the area of hyperæsthesia in the right

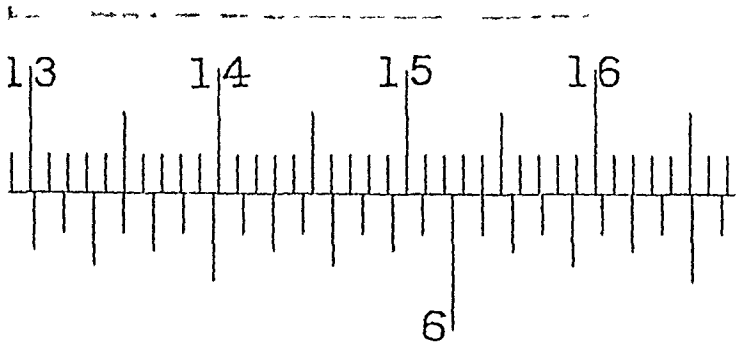


FIG 1.—Intradural extramedullary neurofibroma of the spinal cord, simulating abdominal malignancy

hypochochdrium had also vanished. The slight subjective pain in the right hypochondriac region which had persisted had become very insignificant. The entire expression of the patient had changed and he seemed to be gaining in weight. He was discharged from the hospital May 13, having gained about eight pounds in weight since the operation. For a time his gait was slightly ataxic, but this symptom quickly disappeared. He continued to gain weight very rapidly. His sexual power returned in September, 1922, when he approached his normal weight. He has been perfectly well as regards his spinal cord condition since, in spite of an attack of pulmonary tuberculosis in 1924-1925, from which he recovered at Saranac Lake, where he spent nine months. His present weight is 198 pounds, which is at least ten pounds in excess of his best weight before his illness.

DOCTOR STEITEN said that the reason of his presenting this case of intradural extramedullary neurofibroma of the spinal cord was not because he wished to emphasize particularly the successful result of operative treatment,

but to call attention to the difficulties of diagnosis and to illustrate how a case of this type may readily simulate an intra-abdominal malignant lesion. Even with all the data of numerous previous examinations available and a suspicion that a spinal cord lesion was at the basis of the patient's trouble, it was only possible to arrive at a definite diagnosis after nearly two months of the most careful observation.

COMBINED SECONDARY THYROIDECTOMY AND THYMECTOMY FOR INTRACTABLE EXOPHTHALMIC GOITRE

DR DE WITT SIEMEN presented a woman, age twenty-eight years, who was admitted to the Lenox Hill Hospital, October 28, 1915. She was at that time eighteen years of age and gave a history of having noticed a thyroid swelling for four years, with tremor, increasing nervousness, slight exophthalmos, palpitation, hyperidrosis and loss of weight for two and a half years. The disease progressed in spite of medical treatment and July 24, 1914, the entire right lobe of the thyroid was resected by Dr E. W. Peterson without much improvement in the patient's condition. On April 20, 1915, an adenoma in the lower portion of the left lobe was removed by Dr S. Lloyd, but there still was no improvement, and the remaining part of the left lobe continued to grow. A seven-year older sister was also a sufferer from exophthalmic goitre. Examination of the patient showed the symptoms and physical signs of an advanced case of exophthalmic goitre. She weighed 119 pounds. She flushed easily and perspired profusely. She was so extremely nervous and restless that she was on the verge of a psychosis. She displayed choreiform movements of such a pronounced degree that at times it was difficult to keep her in bed. Her heart was enlarged and there was a moderate tachycardia, 120-130. There was a slight exophthalmos but the usual eye symptoms were not in evidence. There was the typical scar of a collar incision and a decided enlargement of the remaining portion of the left lobe of the thyroid. There was no presternal dulness. X-ray examination showed only an enlargement of the heart with no substernal thyroid or enlarged thymus. Blood count showed a leucopenia with marked lymphocytosis, white blood-cells 5300 with 50 per cent lymphocytes. Her blood-pressure was low, 114/68. There was no alimentary glycosuria. The adrenalin test was negative. The Loewi reaction was not present. There was a pronounced Aschner phenomenon, pulse before eyeball pressure 110, after 100. On injection of pilocarpin gr 1/10, there was a profound, almost an alarming reaction, with such profuse salivation and sweating, that the patient nearly collapsed. The marked pilocarpin reaction, the decided Aschner phenomenon, carbohydrate tolerance, even after adrenalin injection, diaphoresis with clammy extremities, low blood-pressure, slight moderate tachycardia with definite subjective symptoms of exophthalmic goitre, in which the vagotonic symptoms were so pronounced—a case in which if there was any foundation to the theory it might be presumed that the thymus had a preponderating influence.

The patient's condition, in spite of three weeks in bed and careful medical treatment, became worse, and although the case was not looked upon as the best operative risk, it was decided to remove part of the remaining thyroid tissue and at the same time attempt a thymectomy as advised in this type of case by Haberer, Klose, Garié, Halsted and others. After postponing operation on several occasions because of the patient's critical condition—once even sending the patient back from the anæsthetizing room—the operation

THYROIDECTOMY FOR EXOPHTHALMIC GOITRE

was finally performed November 18, 1915. General anæsthesia was used because of the extreme restlessness of the patient. The remains of the left lobe of the thyroid were exposed through the old transverse collar scar and a small portion of the lower part was resected. Exposure was difficult owing to adhesions and cicatricial tissue and there was considerable oozing. A second incision was then made downwards, perpendicular from the transverse incision to below the suprasternal notch. The upper anterior mediastinum was exposed and the fat and glandular tissue lying between the sternum and trachea were removed. The total mass was not large, about the size of a pigeon's egg. It seemed to be mostly fatty tissue but rather more fibrous and more yellow than normal fat. The patient left the table in some shock with a pulse of 168. She promptly recovered from the post-operative shock and although a stormy course was anticipated, her convalescence was most uneventful. There was no real acute hyperthyroidism whatsoever. There was only a very slight rise of temperature for the first two days. Within forty-eight hours the pulse rate came down to 100, where it remained. The reaction was much less than is usually shown by the average case of exophthalmic goitre after the ligation of a single artery under local anæsthesia. This is quite in line with the well-known experience of Haberer, after the removal of even a very small fragment of thymus. The microscopical examination of the tissue removed from the anterior mediastinum showed it to be atrophic thymus tissue imbedded in fat. The patient steadily improved after the operation. Her choreiform movements gradually left her and within two months she had gained 15 pounds in weight. The pilocarpin test was repeated and $gr\ 1/10$ had as little an effect upon her as a dose of distilled water, while on the other hand the adrenalin test became positive. For a time her heart action was variable and her blood picture did not change. Her tremor improved but did not entirely disappear. She began work about two months after her operation and has continued at office work since. She was presented at the January 7, 1916, meeting of the Surgical Section of the New York Academy of Medicine, practically well. In the Fall, 1918, epidemic she survived a severe influenza pneumonia and in the Spring of 1925, she was thoroughly examined by Dr. O. Hensel, who pronounced her a one hundred per cent functional cure.

At a recent examination her pulse was 84, and aside from a slight nervousness without tremor there was no evidence that the patient had ever suffered from hyperthyroidism. In the Spring of 1925, she weighed 132 pounds, but has lost about ten pounds since that time. This she attributes to trouble with her teeth, several extractions and worry over family troubles. Her blood picture is practically normal: white blood-cells, 7200, polymorphonuclears, 57 per cent, small lymphocytes, 35 per cent, large lymphocytes, 7 per cent, eosinophiles, 1 per cent.

DOCTOR STETTEN also presented the sister of this woman, she is seven years older than her sister. Since the age of thirteen she has been a sufferer from exophthalmic goitre. She was operated on by Dr. J. M. T. Finney, in Baltimore, on July 17, 1915, when a subtotal thyroidectomy was done, the right lobe and all but the upper portion of the left lobe being removed. She made a good recovery and was well for nine years, gaining thirty-five pounds in weight. About one year ago her illness recurred with a corresponding hypertrophy of the remnant of the left lobe. She had symptoms very similar to her sister's, except that they were of a much milder nature and that there was a much more pronounced exophthalmos with characteristic eye symptoms. Her pulse rate was only 104. She was admitted to the Lenox Hill Hospital on September 16, 1925, and very carefully studied. The usual tests were

applied and a diagnosis of exophthalmic goitre of the vagotonic type with moderate thyrotoxicosis, was finally arrived at. It was planned to carry out a procedure similar to what had been done in the sister's case and the operation was performed on October 5, 1925, under general anaesthesia. By means of an incision through the old collar scar the hypertrophied remaining portion of the left lobe of the thyroid was exposed. The upper pole was ligated and a wedge-shaped resection of the left lobe was done, leaving only a small portion attached to the trachea. The retrosternal space was now explored for a thymic rest, but nothing could be found, not even fat tissue. There was only a rather mild post-operative hyperthyroid reaction. The patient's further convalescence was quite uneventful.

The first case was presented simply on its face value without any attempt to hold a brief for thymectomy. It may be that the secondary thyroidectomy was just enough to produce the satisfactory result. The main argument in favor of the value of thymectomy is the exceptionally uneventful convalescence, in spite of the extreme gravity of the patient's illness and the severity of the operation, which is an observation that has been made by others. The fact that pilocarpin, which produced such a marked effect before the operation, should become absolutely innocuous thereafter, strengthens the view that the patient's recovery was influenced by the removal of the thymic remnant.

DR ALEXIS V MOSCHCOWITZ said that he has paid particular attention to the cases of exophthalmic goitre which were accompanied by an enlargement of the thymus gland and he has found that as a general rule these enlarged thymus glands cause neither symptoms prior to the operation, nor any post-operative complications. However, Doctor Moschcowitz has lost two cases of exophthalmic goitre during the past year, and in both instances there was present a greatly enlarged thymus gland, sufficient to cause compression of the trachea.

He was interested in the statement of Doctor Stetten that the lobectomy in his case did not produce any amelioration of the symptoms. This experience of Doctor Stetten's is quite contrary to the speaker's experience, as he has found that there is usually a very prompt amelioration of the symptoms following lobectomy, this improvement however, hardly ever lasts more than six months, whereupon there is a prompt return of practically all of the symptoms.

In the operative treatment of goitre, lobectomy takes about the middle place with an improvement of about six months while the improvement after ligation is so evanescent that it lasts only a few days. On the other hand, the improvement after sub-total thyroidectomy is not only prompt, but lasts also a very long time, how long cannot be stated, as the operation of sub-total thyroidectomy is of comparatively recent date.

RETROPERITONEAL SARCOMA (ADRENAL TUMOR) WITH HEMORRHAGE THREE YEARS AFTER OPERATION

DR HAROLD NEUHOF presented a woman, now thirty years old, who came under observation in December, 1922, with the history that an appendectomy had been done two years before for recurring abdominal cramps of several months' duration. After operation, she had felt well for a few

RETROPERITONEAL SARCOMA

months. She then began to experience epigastric fullness after meals, no matter how little she ate. There were no other symptoms. Six months before admission to the hospital she began to note loss of weight which she believed amounted to fifteen pounds at the time of her admission to the hospital. Twenty-four hours prior to admission, violent cramp-like pain in the right lower quadrant began, continuing with increasing intensity. She vomited three times. Bowels moved with enemata. There were frequent chilly sensations and one well-defined chill shortly before admission. When the patient was seen by him one hour before entry into the hospital, a large cystic mass occupying the mesial and right side of the upper abdomen was noted. By the time the patient had entered the hospital, this mass had increased considerably in size.

On admission, the patient was found profoundly prostrated, pale, the respirations somewhat accelerated, and with wan and pinched facies. The general physical examination was negative except for a few moist râles at the right apex. On inspection of the abdomen, a large, rounded, protruding mass was seen, occupying the mid-portion and right side of the abdomen. The overlying skin was tensely stretched and the umbilicus pushed to the left and upwards. The mass was globular, about 20 cm., in its vertical and transverse diameters, smooth, tense, with a sense of fluctuation, tender, and fixed. The overlying abdominal musculature was rigid, but there was no generalized rigidity. On percussion, flatness existed only over the most prominent part of the mass. The white blood count was 21,200, with a differential of 80 per cent polymorphonuclear leucocytes.

Shortly after admission to the hospital, a free right upper rectus incision was made over the bulging portion of the mass. Upon opening the abdomen an enormous bluish tumor mass at once presented. The transverse colon was found to be displaced downwards and the mass appeared to lie in the transverse mesocolon. Over its upper surface, several greatly distended veins were noted. When the hand was passed into the abdominal cavity, the mass was felt to extend to the left as far as the spleen and to the right to the region of the right kidney, but the hand could not be passed around the mass. The deep limits were likewise ill-defined. Because of the firm consistency of the mass, enucleation of the clot and packing did not appear to be a procedure that would be safe or most likely to control the hemorrhage. Accordingly, an attempt at removal was decided upon. The overlying transverse mesocolon was incised and bluntly separated. Additional thin layers of connective tissue overlying the mass were separated, until a plane of cleavage was found. It was then clear that some type of capsule held the blood mass together. The overlying dilated veins were tied off and blunt dissection continued to the left in order to identify the colica media vessels. One branch had to be clamped and these vessels could then be retracted to the left. Further blunt dissection toward the left side of the mass established its retroperitoneal situation in juxtaposition to, but not derived from, the pancreas. Carrying the blunt dissection between pancreas and the mass, the latter could be partly lifted out of the abdomen for the first time. Making gentle traction on it, the right kidney was found to be drawn forwards. Sharp and blunt dissection was then continued over the right lateral aspect of the encapsulated blood mass. The third portion of the duodenum, closely related to the capsule, was dissected free and the pedicle could then be clearly identified. This was a flat mass of tumor tissue attached to the capsule of the upper pole of the right kidney but apparently not involving the kidney itself. The kidney appeared normal in size and consistency. It became now evident that the tumor might not be completely removed without sacrifice of the upper pole

of the kidney Accordingly, mattress sutures of chromic gut were passed through the upper portion of the kidney and tied, the kidney severed beyond these sutures, and the upper pole of kidney, together with the enormous blood clot mass, was removed in one piece A packing of gauze was introduced into the retroperitoneal space, surrounded by a strip of rubber dam; the remainder of the posterior peritoneum was sutured and the abdominal wound closed in layers around the drain

The specimen was a spherical mass from 15 to 20 cm in each diameter with a thin, confining membrane that held the blood clot together Upon section, it consisted of recent and old blood clot and considerable fluid blood Scattered throughout the blood clot were tumor masses of varying size, of grayish color, fragments of tumor tissue being freely distributed toward the periphery The pedicle was a grayish tumor mass of uniform consistency The attached portion of the kidney appeared normal This was confirmed by the microscopic examination The tumor tissue was reported angiosarcoma

The patient suffered considerable shock after operation, from which she recovered in three days Pronounced abdominal distention was controlled by colon irrigations The abdominal wound healed promptly after the removal of the drains Two weeks after operation, when the patient appeared convalescent there was a sudden onset of pain in the right chest and shoulder and physical examination revealed the existence of a pneumothorax This was confirmed by X-ray Two weeks later, pneumothorax had cleared up, its cause not having been determined, and the patient was discharged symptom-free

Up to the present time, there have been no evidences of recurrences of the neoplasm Deep X-ray therapy was employed over a period of several months Two years after operation, the patient was admitted to the hospital for study to determine if possible whether or not recurrence or metastasis existed X-ray examination of the chest and bones was negative A gastrointestinal X-ray examination was negative No evidence of a lesion in the urinary tract was found by cystoscopy Abdominal examination was and remains negative for the presence of a mass suggesting recurrence The patient is in perfect health and has gained about twenty pounds since operation

Although some adrenal tumors present the microscopic characteristics of the organ from which they are derived there are others that can only be identified by their situation and characteristics In this case a careful search was made in the effort to definitely place the neoplasm in the adrenal category No trace of adrenal characteristics having been found, the conclusion that the tumor was probably derived from the adrenal can only be based on the clinical picture The latter as given in this case report, is typical of an adrenal tumor with hemorrhage

INTRADURAL, EXTRAMEDULLARY SPINAL CORD TUMOR

DR HAROLD NEUBOR presented a woman sixty years old, who had been in good health until the summer of 1924 She then began to complain of dyspnoea on exertion In August, pain in the left precordial region began, which was present at frequent intervals This, too, was more marked upon exertion and frequently radiated backwards to the scapula and occasionally down the left arm In September, epigastric distress and some difficulty in swallowing began, the latter being described as a delay of food before it entered the stomach As a result of these manifestations, medical attention was first directed to the cardio-vascular system and, later, to the oesophagus and

stomach. Oesophageal bougies were passed without meeting obstruction and then treatment was directed towards the gastric symptoms. The gastrointestinal examination by X-ray was negative. Until December, the patient was under treatment for the precordial pains and the symptoms referable to the oesophagus and stomach. About December, 1924, five months before admission to the hospital, cramp-like pains in the calves began. These pains were usually present on arising in the morning, to disappear after the patient had walked about for a time. Occasionally, these pains would occur during the night. In February of this year, that is two months before admission to the hospital, the first clean-cut symptoms referable to a spinal cord lesion began. There was first noted difficulty in walking due to weakness of the lower extremities, weakness being more marked in the left. This was progressive, so that, at the time of admission, the patient was unable to walk. There was at no time numbness or tingling or other sensory disturbances referable to a spinal cord lesion. A few weeks before admission difficulty in micturition began, consisting in straining efforts to empty the bladder. This has been progressive but there has been no retention of urine.

Physical examination was in striking contrast to the paucity of the sensory neurological manifestations. The clinical picture was a classical one for a spinal cord tumor in the upper dorsal region. There was profound weakness of the lower extremities, more marked on the left side, the abdominal reflexes were absent, knee-jerks and ankle-jerks were hyperactive and there was a bilateral Babinski phenomenon. On the right side of the body from the level of the fifth dorsal segment downwards, there was considerable impairment of the pain and temperature sense, moderate diminution in tactile sense. The only sensory disturbance on the left side was a belt of hyperæsthesia at the third dorsal segment. The lumbar puncture demonstrated the existence of a partial spinal block.

May 1, 1925, a typical laminectomy was carried out, first on the second and third dorsal vertebræ and then on the first dorsal. The tumor was found at a somewhat higher level than had been anticipated. Upon opening the dura, the spinal cord was found pushed to the right and rotated by a neoplasm lying on its left side, opposite the first and second dorsal vertebræ. It was for the most part of firm consistency, about 2 cm long. The tumor was firmly impinged against the left ventro-lateral aspect of the cord. The only unusual feature noted at operation was the wide attachment of the neoplasm to the inner surface of the dura. After dividing one posterior spinal root that was adherent, the tumor was lifted away from the surface of the cord. The second left anterior root was seen to be attached to the neoplasm and was also sacrificed. In order to remove the neoplasm completely, the dura was freely sacrificed beyond the site from which the tumor sprang. Another reason for this free removal of dura was to obviate recurrence, it being my impression that so-called recurrences of dural endotheliomas may be incomplete removal of the tumor, a fragment being left attached to the dura in the effort to save the dural sac. The dural sac was partly sutured and the remainder of the wound closed in layers. Pathological report was endothelioma.

One unusual phenomenon developed on the third day after operation, consisting in left-sided enophthalmos and narrowing of the palpebral aperture and dryness of skin on the left side of the body from the third dorsal segment downwards. This was apparently referable to some injury of the cord at operation, but cleared up in a few days. The post-operative convalescence was smooth and the patient was discharged from the hospital walking and with fair power in the lower extremities.

It is now six months since operation. There is normal power in both lower extremities, no sensory disturbances and only a left Babinski phenomenon remains as evidence of the previous spinal cord lesion. The precordial distress, as well as the œsophageal and the gastric manifestations, have disappeared.

PERFORATED GASTRO-JEJUNAL ULCER, SIX AND ONE-HALF YEARS AFTER GASTRO-JEJUNOSTOMY

DR HAROLD NEUHOI presented a man, now sixty-seven years old, who was first admitted to the first surgical service at Bellevue Hospital in June, 1916. At that time he presented the picture of an acute abdominal condition for which immediate operation was required. At operation, an abscess in the region of the duodenum was drained. A duodenal fistula developed and a gastro-jejunostomy was done three weeks later. The fistula gradually healed after several months' treatment. A few months later, the patient was under hospital observation for a short time because of some symptoms suggestive of recurrence of an ulcer. X-ray and other forms of examination were negative, however, and the patient then disappeared from observation. From December, 1916 to December, 1922, that is six years, the patient was absolutely free from any symptoms referable to the gastro-intestinal tract. There were no dietary restrictions, alcohol was used in moderation. He was readmitted to the hospital on December 16, 1922, with the following history. About ten days before admission epigastric distress began and, with intervals, was persistent. Three days before admission, the distress was pronounced, the abdomen became distended. Twenty-four hours before admission, severe abdominal pain began, first in the epigastrium and then generalized, and the patient vomited four times. Bowels had not moved for five days.

The man was profoundly prostrated. The pulse was small and rapid, the temperature 102°. The abdomen was greatly distended, especially in its upper half, where slight traces of visible peristalsis were to be noted. There was generalized abdominal tenderness, especially marked on the left side. Generalized abdominal rigidity existed. A high colonic irrigation was ineffectual. White blood count was 22,400 with 92 per cent polymorphonuclear leucocytes.

Shortly after admission to the hospital, the abdomen was opened through a left rectus incision and there at once escaped a considerable quantity of yellowish, odorless fluid in which fat globules floated. Masses of fibrin were seen on the injected serosa of loops of small intestine that were encountered. The character of the peritoneal fluid changed as the exposure was continued upwards. Thin pus was encountered changing to frank thick pus towards the root of the transverse mesocolon. After the pus was removed by suction, a perforation at the gastro-jejunal anastomosis was exposed. This perforation was in the jejunum on the left side of the anastomosis. It measured about 2 by 1 cm and was wide open. The remainder of the anastomosis was represented by a firm infiltrated ring, evidently an extensive ulcer. The short segment of jejunum proximal to the anastomosis was collapsed, that distal to the stoma dilated. Because of the patient's condition, the limits of the gastro-jejunal ulcer were not determined. The operation was begun under local anæsthesia and concluded with gas oxygen. After the nature of the lesion had been determined, the site of perforation was packed off, the transverse colon elevated and two layers of sutures of chromic gut employed to close the perforation. These sutures did not hold well in the

BRONCHOSTOMY FOR BRONCHIECTATIC SUPPURATION

infiltrated tissue and the peritoneum of the adjacent mesocolon was therefore used as an additional flap over the suture line. The wound was closed with drainage.

After a stormy immediate post-operative period, convalescence was smooth and the patient was finally discharged symptom free.

It is now three years since operation and the patient has remained entirely free from symptoms during this period. He has not placed himself under any dietary restrictions. A gastro-intestinal X-ray examination shows a normally functioning gastro-jejunal stoma without any evidence to suggest that the ulcer at the anastomosis has persisted.

BRONCHOSTOMY FOR BRONCHIECTATIC SUPPURATION IN UPPER LEFT LOBE OF LUNG

DR HAROLD NEUHOF presented a woman, sixty-three years old, who came under observation a year and a half ago with the following history. The existence of diabetes was known for about a year. Four months before the time she was first seen by the reporter, a number of teeth were extracted under local anæsthesia. The next day she coughed up small quantities of black material. Thereafter she felt well for three weeks, when coughing of purulent sputum began. This continued for several days. Then, quite suddenly, the patient coughed up a large quantity of foul pus. Fever set in at this time and continued to range between 100° and 104° , often accompanied by profuse sweats. There were several hæmoptyses. Progressive loss in weight was noted and at the time of admission to the hospital, the patient was about fifty pounds underweight. From the time that purulent expectoration began, the sputum was continuously foul smelling, varying in quantity from 5 to 20 ounces daily. On admission to the hospital, four months after the onset of the illness, the patient was found to be in fair general condition but markedly emaciated. The diabetes was of moderate severity. The examination of the chest showed all the physical signs of extensive infiltration and cavitation in the left upper lobe. This was substantiated by the X-ray examination. Bronchoscopy was not satisfactory because of the patient's condition. It appeared to show pus escaping from all the bronchi on the left side. In the diagnosis, a malignancy of the lung had been considered because of the patient's age and general appearance. The history of extraction of teeth did not appear to establish a definite etiology for the pulmonary condition, but it was nevertheless considered the probable cause. With an ante-operative diagnosis of bronchiectatic suppuration in the left upper lobe operation was performed November 18, 1924.

Under local anæsthesia, a segment of the anterior portion of the second rib was removed. There were pleural adhesions over a small area and through these approach to the lung was carried out. Aspiration revealed a small amount of foul material. The lung was incised along the tract of the aspirating needle and was found to be densely infiltrated. This was evidently not the main focus and the infiltrated lung was therefore incised more deeply. At a depth of about 4 cm. from the surface of the lung, a large cavity containing a pool of putrid material was encountered. This was freely laid open by incision through the infiltrated lung, and evacuated by suction. The cavity was then found to have a smooth lining and on its floor presented several large bronchial orifices. Rubber dam and gauze drains were inserted.

Within a few days of operation the purulent sputum had ceased and from that time to the present, there has been no cough or expectoration. The progress of the wound was satisfactory. A soft rubber tube was inserted into

the cavity four days after operation and the bronchial fistula maintained in this manner. Although the wound showed a tendency to close, the bronchial fistula was kept up by keeping a small tube *in situ* for three months after operation. At that time the general condition of the patient was excellent. She had regained the weight that had been lost, the examination of the chest and the X-ray examination showed no evidence of infiltration in the lung, and the fistula was therefore permitted to close. It is now eleven months since operation and the patient has remained well.

DR HOWARD LILIENTHAL called attention to the possibilities of the operation of bronchostomy, the opening of the bronchus for the purpose of aeration of parts of the bronchial tree when filled with pus and which air cannot otherwise reach. Doctors Neuhof and Willy Meyer had done good work in establishing a bronchial fistula in such cases and this operation has its uses if one cannot do anything else to effect a cure. In the first case on which the speaker had seen Doctor Neuhof operate, the patient had bilateral disease and he had believed nothing much could be done for him, but after the bronchostomy he improved, lost the fever, gained weight and there was no further discharge. His other lung got pretty nearly well also. Doctor Lilienthal said he had seen good results follow in another case, in this instance not from a bronchostomy, but from an accidental opening of a bronchus which drained a lung abscess, and the opening was maintained long enough for aeration of the bronchial tree to accomplish good results. However, the operation is far from being devoid of danger. The patient may die of an embolism. The speaker had seen that occur in several cases. The danger of hemorrhage is great. But there are cases in which nothing else can be done. The patient presented was a beautiful example of the drainage and healing of a progressive lung abscess which would have killed her if she had not been operated upon.

DR NATHAN W. GREEN agreed with Doctor Lilienthal that it was a rarity to get an accidental bronchostomy after a drainage case of abscess, although it could not really be called a bronchostomy. The speaker had had a number of these cases and had not yet seen one permanent fistula after a drainage operation. He had seen some of the cases reported by Dr. Willy Meyer in which this condition has served very well to give aeration and the patients have gone along very well, the only disadvantage being that they must be careful when bathing for fear of drowning.

DOCTOR NEUHOF in closing the discussion, said that in the great majority of cases that had come under his care the suppuration was bronchiectatic, and therefore at operation the search was made for the main focus characterized by dilated bronchi. One often finds a smoothly lined cavity containing foul material, whose floor presents several open mouths of dilated bronchi. To establish a long lasting fistula communicating with such bronchi is as much the operation of bronchostomy as in the less common cases in which considerable infiltrated lung must be traversed to find a dilated bronchus that is not part of a bronchiectatic cavity. The principle of the operation is not drainage in either case, for drainage would be discontinued when the

FRACTURE OF SHAFT OF FEMUR

discharge had ceased. If the latter were done there would be prompt recurrence of the manifestations of the disease. The principle is the ventilation or aeration, by way of the bronchial fistula, of an anaerobic bronchiectatic suppuration. A drainage operation may have its field in the parenchymatous abscesses that are not anaerobic or bronchiectatic. Since 1919, when he first practiced the operation of bronchostomy on Doctor Lilienthal's service at Mount Sinai Hospital, the speaker has performed the operation in forty-three cases. Of these, four have died, two of cerebral embolism, one from anaerobic suppuration in another lobe of the lung, and one from the continuation of a virulent infection uninfluenced by operation. Of these cases three can be classified as acute gangrene, in which the prognosis is always grave. Of the remaining thirty-nine cases the great majority are well, the others improved. There is one case not doing well, in which there was probably an error in diagnosis, the lesion being suspicious of tuberculosis. In view of these results the question is what alternative procedures should be advocated in the operative treatment of anaerobic pulmonary suppuration.

FRACTURE OF SHAFT OF FEMUR, DELAYED REDUCTION BY SKELETAL TRACTION

DR JOHN A MCCREERY presented a man, aged forty-two years, who was admitted to the First Surgical Division of Bellevue Hospital, September 9, 1921. Shortly before admission he had fallen about twenty feet into the hold of a ship, the broken beam on which he had been sitting falling on top of him. The injuries sustained consisted of a compound fracture of the lower jaw, a fracture of the right humerus in its middle third, and of the right femur at the junction of the lower and middle third. He was immediately put in suspension and traction apparatus, with skin traction, the weight of ten pounds being applied to the femur. For some time following the injury the patient was extremely ill, developing broncho-pneumonia, and was restless and hard to control.

An X-ray taken twelve days after injury showed overriding of about one inch. Eight days later this had increased to nearly two inches with posterior displacement of the lower fragment. Skin traction was obviously inadequate, in part due to the man's unusually good musculature. Three weeks later there was apparently union with two inches of shortening, and a firm mass, presumably callus, could be felt around the bone ends. Open operation seemed contra-indicated as the man seemed only just recovering from pneumonia and still had an infected mouth, as a result of the compound fracture of the lower jaw.

It was decided to try caliper traction, although it was not believed that this would be efficient. Accordingly calipers were applied with a weight of twenty-five pounds for forty-eight hours. This was then increased to sixty pounds without complaints on the part of the patient, who said, however, that twenty-four hours after the increased weight had been applied he felt something slip in his thigh. This was confirmed by X-ray, which showed a definite diminution in the shortening and beginning formation of callus. This traction was continued for ten days when it was reduced to thirty pounds and ten days later to twenty pounds. X-ray taken three weeks after beginning caliper traction showed the overriding completely overcome but with persistent but decreased posterior displacement of the lower fragment.

The calipers were removed from the femur one month after application, and at that time the measurements from the anterior superior spine to the internal malleolus were equal on the two sides. The patient was discharged from the hospital on crutches four months after admission. At that time he had forty degrees of motion in the knee-joint from a straight angle. When seen ten months later, this had increased to eighty degrees. At the present time he is working as a longshoreman without disability.

This case is of interest in demonstrating the possibilities of skeletal traction in cases where a certain amount of union has already developed.

TRAUMATIC RUPTURE OF SMALL INTESTINE IN AN HERNIAL SAC

DR JOHN A. MCCREERY presented a man, who was admitted to the First Surgical Division of Bellevue Hospital, November 21, 1921. A few hours before admission he had been cranking an automobile which started forward, wedging him between it and a box car, the bumper of the truck catching him in the right groin. Following the accident he had had constant severe pain around the umbilicus, occasionally radiating to the right groin. He did not vomit nor did he feel nauseated. His previous history was irrelevant, except that for ten years he had had a reducible right scrotal hernia.

On admission the man was in slight shock complaining of severe generalized abdominal pain. There was generalized abdominal rigidity and tenderness both more marked in the lower abdomen. There was a tense, non-tender reducible right inguinal hernia. At operation performed eight hours after injury, it was found that the small intestine about 6 inches from the ileocaecal valve had been cut through transversely, the laceration extending about $1\frac{1}{2}$ inches into the mesentery. It was a clean cut as though done with a knife. Both ends of the intestine were open and the upper end was discharging fecal contents into the pelvis. The peritoneum was congested and lustreless and there was already a considerable amount of fibrin in the pelvis and on the surface of the small intestine. Because peritonitis had already developed, no attempt was made to repair the divided intestine, both ends of which were brought out through the lower end of the exploratory incision. The pelvis was emptied by suction and a cigarette drain inserted.

His post-operative course during the first week was marked by moderate distention which was controlled by lavage and irrigation through the protruding loop of small intestine.

Eight days after the first operation an end-to-end repair was made with two layers of chromic catgut, the inner mucous membrane suture, the outer seromuscular, and the protruding intestine was then reduced into the abdominal cavity, after gently separating adhesions. The abdominal wound was closed loosely.

Following this the patient was made uncomfortable by a post-operative parotitis which was found to be due to staphylococcus albus, and which subsided after ten days of repeated massage. The repair of the fistula was not permanent, a small amount of fecal discharge appearing five days after operation and continuing in diminishing amounts for five weeks.

At the time of discharge from the hospital, two months after injury, the wound was entirely healed. His inguinal hernia at this time seemed cured, as there was no impulse or bulge noted and a hard non-tender mass could be felt in the canal, extending a short distance below the external ring, presumably organized exudate in the hernial sac.

He was seen at intervals in the follow-up clinic, and it was noted that

TRAUMATIC RUPTURE OF SMALL INTESTINE

there was developing a ventral hernia at the site of his exploratory incision. This has been controlled by a belt. A definite recurrence of the right inguinal hernia was noted first two and a half years after his injury. In view of patient's age and his occupation, which involved no manual labor, this has been kept under control by a truss rather than operative repair.

The character of the injury in this case was such as to suggest that the intestine had been divided in the hernial canal by the impact of the bumper cutting it on the ramus of pubis, and he is shown as a case of intestinal rupture from a rather unusual cause. The temporary cure of his hernia, presumably by organization of exudate in the inguinal sac, is also of interest.

TRAUMATIC RUPTURE OF SMALL INTESTINE DUE TO EXTERNAL VIOLENCE

DR CARL EGGERS said that in 1922, he had a case similar to Doctor McCreery's. December 11 of that year he was called to see a lady, seventy-two years of age, on whom he had done a nephrectomy for right pyonephrosis, by the transperitoneal route, a year previously. At six o'clock of that same evening, feeling perfectly well, she suddenly stumbled while stepping from the sidewalk onto the street, and collapsed, striking her chin. She was picked up by a taxi driver and taken home. She immediately complained of agonizing pain in the right side of her abdomen and was in a state of shock. She stated that she felt as if something had given way inside. A physician who saw her soon after the accident believed the condition had some relation to the abdominal scar. He administered morphine and, when the pain did not subside, gave her a second hypodermic about two hours later.

When Doctor Eggers saw the patient, at 9.30 that evening, she was in a state of shock, was very pale, pulse 74 and temperature 100. She complained of severe pain over the entire right side of the abdomen and, in addition to that, of a terrible pressure as if from a heavy weight. Three times during the abdominal examination she vomited clear stomach contents. She was unable to void, although she had a desire to do so, she had voided last before 5.00 P.M., about one hour before the accident. She had worn a double truss for bilateral inguinal hernia while out walking. The abdomen was slightly distended and there was marked tenderness and some rigidity over the entire right side. There was no irregularity in the scar of the former operation which might suggest a hernia. Further examination showed that the left inguinal hernia was easily reducible and not at all tender, the right one, which was much smaller, was irreducible and extremely tender, so that she could not bear having it touched. A tentative diagnosis of strangulated hernia was made, although it hardly explained all the symptoms and signs.

Operation was performed at the Lenox Hill Hospital six hours after the accident. Local (one-half per cent novocaine) anæsthesia was used. While injecting the solution the tension in the hernial sac suddenly seemed to disappear, although just before the injection it had been larger and more tense than early in the evening. Proceeding with the operation the sac was found to be thick-walled, as soon as it was opened turbid fluid exuded which was cultured, later being reported negative. A great deal of this fluid was mopped out. It looked like contents of small intestines, there was no fecal odor. The sac was split completely for thorough examination, and a loop of small intestine was then picked up which looked red and injected and showed fibrin deposits. There was no free gas in the abdomen. It was impossible to bring the cæcum and appendix into view. Upon picking up another loop of small gut for exploration, a ragged hole, about one-half inch long was

discovered opposite the mesentery. Its edges did not look fresh, they were covered with a grayish deposit and there was no bleeding. The long axis of the tear corresponded with the long axis of the gut. There was no induration of the wall. The tear was closed with one row of silk sutures, and the loop dropped back. The remaining fluid was sponged out, and closure of the sac and a hernial repair completed the operation. The wound was not drained.

The rupture of the small intestine in the hernia sac was due in all probability to pinching of the truss. The lining of the sac was red and velvety, histological examination showed acute suppurative inflammation with destruction of the endothelial lining.

The immediate post-operative condition was very good, there was almost complete relief of pain and vomiting ceased entirely. Towards the end of the second day moderate abdominal distention developed, with tenderness and rigidity over the lower quadrants. This continued, although she passed gas freely. She also developed gradually increasing temperature which could not be explained except on the basis of a mild peritonitis, until she developed peritonitis on the left side, a small patch of pneumonia in the left lower lobe and a mild superficial infection in the wound. In addition to all this, she began to vomit about ten days after the operation and complained of abdominal pain. No explanation could be found for this until it was noticed that the left hernia, which had hitherto been easily reducible, could no longer be pushed back. It was hard and tense and very tender, although the patient had not complained of pain in that region. As soon as her condition warranted, fifteen days after the accident, the left side was opened, also under local anaesthesia, and a large sac was exposed which exuded clear fluid when opened. A mass of omentum was firmly adherent within it and there was redness and a thick deposit of fibrin. The omentum was separated and reduced, the sac removed, and a Bassini hernioplasty was done.

The convalescence after this was uneventful, the wound healing by primary union.

The explanation of the incarceration of the left side is probably the following. The extravasated intestinal contents set up a mild peritonitis, especially in the hernia sac in which it stagnated and, when the omentum drifted into it, adhesions formed and prevented reduction.

The interesting points in this case are the severity of the lesion in relation to the comparatively slight trauma which consisted only in pinching of the gut by a truss, with no external evidence of injury, and the severe degree of peritonitis set up in the course of six hours.

The question of drainage in these cases is also of considerable interest. Doctor McCleery's case was drained, my case was not drained and was followed by primary union except for a slight subcutaneous infection. It is surprising how nature takes care of these aseptic exudates from the small intestines. For example, two cases of rupture of the small gut due to external violence, with no visible marks on the abdomen, were observed by me during the late war. Both patients were soldiers and were struck on the abdomen by a mule. The first case was said to have been thrown about sixteen feet, and the other almost as far. One patient was operated on by Major Wm Crawford of Savannah, Ga., at the Base Hospital, Camp Jackson, S. C. He found a partial tear of the small intestines. After repairing the laceration

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and sponging out the exudate, the wound was closed without drainage, and primary union resulted, except for a slight superficial infection. The second case had an extensive hemorrhagic exudate due to laceration of vessels in the transverse mesocolon, and a complete severance of the small intestine about the junction of the jejunum and ileum, extending into the mesentery. The vessels in the transverse mesocolon were ligated by Doctor Eggers and the tear repaired. The gut was then united by end-to-end anastomosis and the exudate removed by sponging. No drainage was instituted and the wound healed by primary union except for a superficial infection.

These cases seem to indicate that it is not necessary and is even inadvisable, to drain the abdomen in patients with exudates from the small intestine, for nature takes care of the peritoneum very nicely while there is apparently less resistance in the subcutaneous tissue.

TREATMENT OF FRACTURES OF THE FEMUR IN ADULTS

DR RODERICK V. GRACE read a paper with the above title for which see page 279.

DR H. H. M. LYLE said with regard to open operation, it seemed to be the general opinion that this field had been lessened by the successful employment of skeletal traction. He has noted that many of the plated cases have a great deal of stiffness and limitation of motion in the knee-joint. This is due, he believes, to three factors:

1. The trauma and damage to the muscle by the original lesion.
2. To the trauma of the operation.
3. To long immobilization.

It is extremely important, in plated cases, that early movements of the knee are begun as soon as the wound is healed, otherwise a stiff knee will result in a fair number of the cases. Skeletal traction has another distinct advantage in that it can be used as a preliminary measure in dragging down bony fragments and stretching out the muscles so that a reduction of the fragments can be made.

DR J. M. HIRTZROT could not agree with Doctor Lyle that disability in the joints was a necessary adjunct of the treatment of a fracture of the femur by a steel plate. Movement in the joints can be practised early by the use of the splints devised by the speaker and reported before this Society in 1912 and in 1914 (Johnson's Surgical Therapeutics). In fact the fractured femur could be out of bed in the ambulatory splint in from three to four weeks after the operation in selected cases.

In any discussion of fracture of the femur the age incidence must be considered. Cases from birth to twelve years. The results are good if the axis of the limb is corrected and gross overriding attended to by a varying number of methods, and growth will take care of the shortening as all well know. Between 18-35 to 40, especially in robust muscular individuals the problem is different.

Skin traction is not efficient in any except the rare instance. That is especially applicable to this group. Reduction by manipulation under an

anæsthetic, if done immediately after the fracture, will also give a favorable result in properly selected cases, namely, the transverse fractures in which the fragments can be brought end-to-end. The number of these cases is also infrequent. By far the larger number, however, cannot be satisfactorily handled by the above means.

Fracture of the femur is a serious injury. At present there is too much assurance that if the overriding is corrected that that is quite sufficient, and once that is accomplished that everything has been done. Emphasis should be laid upon the fact that the preservation of the normal axis of the femur in its weight-bearing line for each individual is of as great if not greater importance than slight degrees of lateral displacement or overriding. That is, the normal femur is never a straight bone. It has a varying curve or curves. Anything which alters this normal curve will result in disability and this disability will increase with time due to the secondary changes which result in the hip, knee and ankle. The speaker has followed cases since 1912 to note the effect of this disability and angular deviations from the normal axis have produced disabilities which should be preventable if this deviation from the normal axis had been given the proper attention.

There is no question about the value of skeletal traction, however, he himself had not been favorably impressed by the results which were being obtained due perhaps to the faults in the correction of the axis of the femur above discussed. In 96 cases of fracture of the femur treated by skeletal traction in the Metropolitan area, reviewed for the purpose of estimating the industrial disability, only four had results which could be classed as entirely satisfactory, of the remainder many had to be given a disability rating of from 60 to 100 per cent of the involved leg due to varying degrees of disability. The disability involved the knee-joint, the thigh muscles, and the foot (weak foot). There was also a varying degree of angular deformity with deviation from the normal axis in far too many cases to consider the method as used as correct. Naturally any method improperly used cannot give the most desirable result. The point to be emphasized is that skeletal traction is not a simple method. It requires skill and training and a proper understanding of the result to be accomplished, before it can be used intelligently. The impression extant that when tongs, etc., are applied to the femur and the overriding corrected, the deed is done and will result in no great advance in the treatment of the fractured femur. Correctly used, it is a distinct advance and will and should supplant most other methods for fractures of the shaft of the femur.

With regard to the open operation and the use of the steel plate in fractures of the femur, wisely used in selected cases it is of the greatest value especially in the group of cases most difficult to correct because of powerful muscles, interposition of soft parts, etc. Operation is seldom required under twenty and should rarely be used over forty. It is not a

method to be used by the occasional surgeon, who is not properly equipped and it is a nice point to decide which surgeon has that equipment. That there are men so fitted that they can and do use the steel plate and the open reduction with great satisfaction cannot be disputed. To the surgeon who has any doubt about the matter, the only admonition which can be given is, don't use the method, use any other method, because safety first is better than regret after. The time of operation is also of the greatest importance, there is a marked difference between operations done before the twelfth day and those done after fifteen or twenty days. The early operations disturb the normal bone formation but little, whereas, the operation later interferes with the normal sequence of bone repair and the plates causes trouble. This disturbance in the normal sequence of events in bone repair is emphasized by Hey-Groves as one of the chief factors in non-union and delayed union.

While he held no brief for the bone plate, Doctor Hitziot felt it had a distinct place in the treatment of the shaft of the femur. He was not prepared to give exact figures, but he had used the plate in approximately 100 cases, with one death and two infections, which necessitated the removal of the plate. All three cases were improperly selected and he would not now operate in similar types. In the remainder there were no non-unions, no stiff knees, no plates removed and except for the muscle atrophy in the line of the scar, no changes in function or in the anatomy worthy of note.

After forty, operation is probably never indicated because of the danger connected with the operation, and in the older people that method should be selected which would fit the needs of the case, that is, the treatment should take in the patient as a whole and not the femur alone.

Some disability is almost unavoidable after fifty, no matter what the treatment or how skillful and this fact should also be recognized, as it is recognized in such frequent fractures as those at the base of the radius.

Doctor Grace has spoken of excessive callus formation in one of his cases which he attributes to the plate. Doctor Hitziot's impression was that the plate was loose and because it was loose its movement produced irritation at the fracture line and interfered with the normal bone production and condensation, hence the failure in union.

With reference to the period of disability as related to the complete restoration of function, complete function is not restored until the joints and especially the muscles have regained their full activity and this will always vary with the willingness of the patient to actively use the muscles of the involved leg. No other method will completely restore the muscle power, except active intentional methodical use. Statements that weight-bearing was allowed on such and such a date and the consideration that the cure is accomplished when that is possible without support are extremely misleading and of no value in estimating the completed result. The rate of the bone repair will vary but very little in any given series if not inter-

ferred with, but the rate of the muscle power return will depend to a large degree upon the cooperation of the patient. The willing workers will have the short periods of disability, the willing shirkers will have the long periods of disability.

DR HAROLD E. SANTEE said at Bellevue, on the Second Division, in the past ten years there have been 134 fractures of the femur below the trochanteric region, of which 118 were simple fractures. This period has been one of evolution in treatment and of progress. In this evolution of treatment from Buck's extension, to skin traction and plaster, to skin traction with suspension, to skeletal traction with suspension, it is only fair to state that excellent results have attended the use of any given method in chosen cases. The difficulty is to prophetically choose the cases for any type of treatment except skeletal traction. Certainly the latter treatment gives the maximum and most adequate control of the fracture.

With skin traction, it has been practically impossible to use over twenty pounds for any length of time. Occasional cases have held for a short time at twenty-five to twenty-eight pounds but never for long. This will not reduce many fractures of the femur.

Skeletal traction gives practically unlimited poundage, moreover when applied to the femur itself, it is applied at its maximum efficiency. For this type of traction in femoral shaft fractures, the Finochietto band has been used in six cases—not satisfactorily, the Steinmann pin in twelve cases—two through the femur, ten through the tibia for low femoral fractures. Forty-eight cases were tonged, eight at least were reapplied for slipping or poor placement. The complications met with and possibly attributable to the method have never been early—but rather late and equally attributable to intercurrent infections except in two cases. They are four in number—one an erysipelas with abscesses of scalp and both eyelids at one week developed a streptococcic knee on the side tonged after one month. His tong wounds showed a staphylococcus. His knee-joint cultured a hæmolytic streptococcus. Naturally tongs were removed. His ultimate result was a stiff knee and two inches shortening. A second case with multiple associated injuries developed after two weeks a general erythematous dermatitis and hæmolytic streptococci were recovered from his tong wounds and from Finochietto band wounds in the other leg. His tongs were removed. Neither of these two cases is directly attributable to tongs. Of the other two cases, one had a pustular dermatitis and one no such complicating factor. Both developed staphylococcus infection around the tong wounds and popliteal space sufficient to stiffen the knee. Both were mobilized under anaesthesia twice each and obtained over 90° flexion with full extension. Both showed shortening after removal of the tongs.

The results as to shortening shown on the following records of 41 cases are no shortening, 13, one-half inch or less 7, one-half to one inch, 8,

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one to three inches, 3, fibrous union, 3 Lengthening occurred three times, one-half inch, three-fourths inch one and one-half inches

In the use of skeletal traction which permits of maximum control of the fracture one's standards of judgment and self-criticism should be correspondingly high According to such standards, many cases had been failures, but on analysis such failures are more those of application of the method than of the method itself

DR JOHN J MOORHEAD stated that three or four years ago at the Surgical Section he reported a series of femur cases treated by skeletal traction Except for fractures of the neck of the femur, he regarded skeletal traction as indicated under four conditions (1) When there was shortening of an inch or more, (2) in heavy muscled subjects, (3) in cases seen after twenty-four hours, (4) in the supra-condylar group He called the above the irreducibles because in his hands nothing except skeletal traction or open operation would overcome the deformity He preferred the nail to other forms of skeletal traction To prevent the infection over the protruding nail ends he uses a wet dressing of iodine saline, that is one dram of iodine to a pint of saline solution

Skeletal traction has made it unnecessary for him to do any form of open operation in recent years, and even in old cases osteotomy and skeletal traction at the same sitting made this troublesome group amenable

DR HOWARD LILIENFELD said there was one point about plating simple fractures that he wished to mention Many surgeons have had accidents during or after this procedure, but those depending on infection can be avoided by plating the fracture with the Lane plate and using a screw with an extended shank, leaving the wound wide open and beginning the Carril-Dakin treatment at once The plate should be in place for three or four weeks At the end of that time a sufficient amount of new bone has formed so the plate can be painlessly removed Then the fracture should be dressed with plaster-of-Paris The speaker has had good results with this method He has never had to take out a plate before the end of the four weeks and he has had no failures, although some of his patients with open fractures were desperately ill from previously existing infection He wished it understood that he referred only to those cases in which it was necessary to plate He began the physiotherapy at the earliest moment

DR JOHN C A GERSHBERG said that where skin traction had failed to overcome shortening, skeletal traction has been successfully employed as late as fourteen to eighteen days after the fracture and shortening was overcome In one case, a completely healed fracture with three inches of shortening was operated on, the fracture reestablished and by strong skeletal traction (nail extension) shortening was overcome and union took place In another case with compound comminuted fracture of both bones of the leg, fracture of upper third of femur and compound fracture-dislocation of the elbow, skeletal traction was applied to femur for three weeks This prevented

shortening but did not control angulation of upper fragment. Plating was done to correct this. Four years later the man was drafted and sent overseas, his fracture, etc., not having resulted in any disability. He still has the plate in his thigh. As to the length of time of leaving the skeletal traction, the speaker had left it in twenty-eight to thirty-five days and had no infection. He did not use wet dressings but used aïstol and collodion. As to the removal of the nail in cases where one is not sure the callus is solid enough to hold the bone, if one uses Hackenbruch turn buckles with a plaster spica divided opposite the site of the fracture, the distraction of the two parts of the spica can be performed before removing the nail extension, thus maintaining correct position before release traction.

DOCTOR GRACE, in closing the discussion, said that death in some of these cases might be due to fat embolism. He believed in the importance of preserving the anterior bowing of the thigh and tried to have flexion of the knee early.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting Held November 2, 1925

The President, DR. EDWARD B. HODGE, in the Chair

IMPROVED SUPRAPUBIC DRAINAGE APPARATUS

DR. BENJAMIN THOMAS exhibited an apparatus which with various modifications had been in use in his hospital services for the past ten years. It consists of metallic bevelled-edged cup having a Y-like diam, one arm of which leads from the dome, the other from the lower portion near the rim. In the concavity of the cup, screwed to the drainage exit, is a detachable metal tip to which is attached a rubber tube for introduction into the bladder. To the stem of the Y rubber tubing is attached leading to a bottle under the bed or if the patient is ambulatory, to a rubber bag strapped to the thigh. The cup is held in position by a belt passing around the abdomen, this is made to be easily detachable to the exterior of the cup. Through eyelets near the brim of the lower extremity of the cup, a rubber perineal tube or cord passes between the legs and is tied to riders on the belt at the level of the iliac crests.

The saving in the cost of gauze and cotton by this apparatus in suprapubic cystostomy is enormous.

The cup as it stands to-day has certain definite dimensions. These are necessary in view of the fact that the distance between the central drainage area and the lower part of the cup must be shorter than the distance between this drainage exit and the top, otherwise there will be too much impingement on the symphysis resulting in excoriation of the skin. The distance from the centre to the bottom is 5 cm. and from the centre to the top is 6 cm. The width is 7 cm. A material advantage of this cup is that if there occurs leakage around the tube entering the bladder, the urine escaping into the concavity of the cup drains out the lower arm near the brim and in this way all drainage will be taken care of.

The central metallic attachment is removable, with the tube entering the bladder, usually at the end of two days. The latest improvement has been this rubber cushion ring recently provided by Eynard, of Paris, which can be sterilized by an antiseptic solution or by boiling for one minute and has the advantage of lessening the excoriation and making the patient more comfortable and permitting of less leakage. Nine out of ten patients can be kept dry by this drainage apparatus, occasionally, in large fat individuals, or in exceptionally thin patients, we find some difficulty.

2 *New Prostatectomy Lobe Forceps*—These forceps are similar to the usual stone forceps, except that they have heavy teeth so that when the lobe is grasped there will be no slipping. The main feature making the forceps useful is that the tips of the blades are fairly thin, and it is easy to slip the blade between the prostate and the false capsule, in the case of Young's forceps the tips are too blunt or "bull-nosed." These forceps are also used suprapubically in removing prostatic lobes from the bladder or prostatic urethra.

3 *Prostatic Bar Punch*—This instrument is a punch which is to be used suprapubically. It is essentially a giant-sized Gaitman's tonsil punch. One is often unable to punch out the obstructive bar at the neck of the bladder with Young's punch. In such case this instrument will be found useful. Occasionally there is a great deal of bleeding following the punch operation, but if the punching is associated with a cystotomy, one has it under control and hæmostatic measures can be applied immediately. Moreover, if there be a bad cystitis, efficient drainage can be instituted and lives saved.

COMPLETE EXTIIRPATION OF THE PENIS

DR THOS C SILLWAGON presented two cases. In one case the carcinoma of the penis that had involved the urethra and both groins was so extensive that he was passing urine through a number of sinuses. A complete extirpation of the penis was done. His cure was delayed by infection. He has gained fifteen pounds in the two years following his operation. He has complete vesical control. Previous to operation this man had had radium treatment. He had had five cases altogether, two are alive one at five and one-half years since operation and the other at three and one-quarter years.

The second case was operated on in the Jewish Hospital in May. At the extirpation some portion of the scrotal sac was left.

In operating upon these cases he had used the ordinary circular amputation with removal of the lymph-nodes, this has been done in six cases, four of whom are alive. In cases where the growth extends to the abdominal cavity, it is necessary to go up to the bifurcation and try to remove the sheath of the vein. The more radical the operation the safer it is for the patient. He always asks the patients if they wish to retain the testicles, but he believed attempts to save the testicles left a distinct menace to the patient. In one patient where the testicle was saved, the patient later asked that it be removed, because of the physical discomfort it caused him for he had to lift it when he wanted to urinate.

He did not mean to preach the radical operation because if one gets these cases early enough he believed one can effect cures by the ordinary circular amputation.

DR BENJAMIN THOMAS said that he had operated on seven or eight cases of carcinoma of the penis, of these three were total extirpations, but in all he left the testicles behind. He entered a plea for the conservation of the testicles in this operation of complete extirpation of the penis. Total

ECHINOCOCCUS CYST OF LIVER

emasculation is unnecessary is disfiguring and extremely undesirable on the grounds that it may lead to destruction of the normal internal, if not the external sexual characteristics on the grounds that the testicles may possess an internal secretion. The characteristics of the Eunuch must not be forgotten.

Dr. JAMES R. WILTS referred to a case of this kind operated upon by himself. A total extirpation had been performed two and one-half years before. The man was thirty-two years of age. He stated that following his operation he had had absolutely no difference in his feelings or in his sexual life.

ECHINOCOCCUS CYST OF LIVER

Dr. HENRY P. BROWN Jr. presented a man twenty years of age, a native of South America who came to the Presbyterian Hospital in April last, on account of pain and swelling in the epigastrium. He was referred to Doctor Allen's service to whom he was indebted for the privilege of operating upon and reporting the case. The man first noticed in 1923 that his abdomen was getting larger in its upper part. He had no discomfort or other symptoms. About one year ago (1924) he began to have pain in the right side of the epigastrium when he worked hard or lay on his right side. There was no pain or tenderness at any other time. No jaundice, loss of weight, or gastro-intestinal disturbance. There was slight loss of strength. He can eat all kinds of foods and has no dislike for fats. There is no dyspnoea or oedema of feet or ankles. Slight cough for past three years especially at morning and night. No haemoptysis. Night sweats for past five years. Feels hot and flushed in afternoons. Pleural effusion without pneumonia seven years ago. No genito-urinary or nervous symptoms.

He had lues in 1924 for which he received salvarsan. He is a laborer, is single and the family and social histories are unimportant. He has been in this country about two years. He was well developed, rather poorly nourished and presented no evidence of jaundice. The head, neck, chest, heart and lungs are essentially normal. The upper abdomen is much enlarged and palpation reveals a mass which fills the upper abdomen on both sides. It is quite hard and smooth and not tender, the impression from palpation and percussion being that it is an enlargement of the liver and spleen meeting in the midline. Dulness in the flanks is present and there is an impulse transmitted through the mass on tapping the abdomen.

The temperature, pulse and respirations on admission were 98.3-90 and 20 respectively. Wassermann positive and urine analysis essentially normal. Blood count showed red blood-cells 3,820,000, white blood-cells 6,800 and haemoglobin 76. X-ray reports that "On right side there is a marked flattening of the diaphragm, loss of cardiophrenic and costophrenic angles. Upper border of diaphragm reaches to sixth rib. Below diaphragm on right side extending over toward left side is a uniform shadow in upper central portion of abdomen. Impossible to give any detail of this shadow." An exploration was done. The liver was greatly enlarged and in the anterior and diaphragmatic surfaces there presented a large cyst which rose above the substance of the liver. The wall of the cyst was smooth and tense. After walling off the intestines and peritoneal cavity it was aspirated, clear colorless fluid being evacuated. One small typical daughter echinococcus cyst escaped, and four quarts of fluid were removed from the main cyst cavity. A rubber tube was sewn in for drainage, a piece of the wall removed for the pathological laboratory and marsupialization done. The finger could not palpate the depth of the cavity, it being about 10 to 15 cm. deep.

In spite of slow evacuation of the cyst contents, his pulse rose to 160, coming down in twenty-four hours to 112. There was a moderate post-operative febrile reaction which subsided in four days.

He drained profusely and it was not till the twentieth post-operative day that daughter cysts began to appear. He was discharged from the hospital July 8, sixty-five days after operation, at which time the cavity held two ounces, pieces of cyst were occasionally recovered and a small drainage tube was still in place. His cyst cavity had been irrigated daily with Dakin solution.

He was treated in the dispensary for eighteen days, during which time the drainage became more profuse and daughter cysts were recovered at each dressing. He had no discomfort, was feeling well and was anxious to be readmitted and have an attempt made to close the cavity.

Thinking that it might be possible to enucleate the wall of the mother cyst, the reporter reoperated upon him on July 24, 1925. The external opening of the sinus tract was dissected free and the cyst cavity opened and explored, the peritoneal cavity having been walled off by adhesions. The cyst cavity extended upward toward the diaphragm to about the level of the sixth rib on the right side. Its lining felt thick and leathery and contained many crypts. It was considered inadvisable to attempt to remove the lining and the cavity was wiped out with gauze and a large rubber tube sewn in place. Patient reacted satisfactorily from the operation and second-hour irrigation of the cavity with Dakin solution was instituted. The daughter cysts continued to be discharged quite freely for a few days and then began to show disintegration, the last one being seen on the ninth day after irrigation was begun.

He was discharged on the forty-eighth day, having only a small sinus which discharged very slightly. October 29 he was seen and his sinus had entirely closed, the abdominal wall was strong and there was no evidence of a recurrence.

DOCTOR BROWN presented a second case in the person of a woman, a native of Armenia, aged thirty-two years who was admitted to the Presbyterian Hospital in Dr. E. H. Goodman's service May 5, 1925, on account of colicky abdominal attacks with vomiting, from which she had been suffering at intervals for a month. There was also a mass to be felt to the right of the umbilicus, which has increased in size. The first attack of pain lasted about one week and then disappeared. It has since then occasionally returned for short periods. She first noticed the mass in her abdomen four years ago, at which time she says it was much smaller than when her physician saw it in April. She has never been jaundiced and her bowels are somewhat constipated. She has always been well except for some dysmenorrhœa. Has not lost weight.

Her abdomen was flat and scaphoid, no tenderness or rigidity. There were two masses in the right upper quadrant, hard in consistency, each about the size of a peach, the upper one seeming to be attached to the lower edge of the liver while the lower is in the right kidney region. Both seem superficial and move with respiration, while the lower moves with pressure over the kidney region posteriorly and gives the impression of being attached to the kidney. Pressure on one mass moves the other. The rest of the abdomen is negative.

June 15, 1925, Dr. Edw. B. Hodge opened the abdomen. The ascending colon was found to be pushed to the right wall of the abdomen. Dense omental adhesions obscured a hard, firm, pyriform mass originating from the inferior surface of the right lobe of the liver. The base of the mass extended into the hepatic tissue. While attempting to release the mass there was sud-

PARTIAL HYDRONEPHROSIS

denly released a large quantity (about 400 cc) of clear straw-colored fluid, and from the rupture in the wall of the cyst there was released many small cystic bodies typical of echinococcus. The cyst was packed off from the rest of the abdomen and the opening enlarged, evacuating about eighty to one hundred daughter cysts, varying from 2 mm to 5 cm in diameter. The mother cyst extended upward into the liver, toward the left lobe. The gall-bladder was apparently normal. The inferior of the cyst was scraped with gauze and marsupialized to the peritoneum. A cigarette drain was placed under the liver and the cyst cavity tightly packed with gauze. The wound was closed in layers.

The patient made an uneventful recovery, the gauze drain being removed in five days and a rubber tube substituted. There was at this time a good deal of sanguinous discharge, the patient being quite comfortable.

Fifteen days after operation she was discharged with a small rubber dam in the cyst. From this point she was treated by her family physician.

At examination made October 29 the sinus was found to be closed, the patient to be in good health, there is no evidence of recurrence.

Dr. EDWARD B. HODGE remarked as to the second case reported by Doctor Brown that there were two distinct masses present on palpation. One was in the convex border of the liver and the other was lower down, a little lower than where we ordinarily find the enlarged gall-bladder.

The upper mass was firm and tender, and he thought it was carcinoma of the liver. It turned out to be all one cyst. This was the first case of the kind that he had ever had.

Replying to Doctor Ashurst's question as to whether this cyst was recognized as an echinococcus cyst at operation, he said that he did not know it was before operation but recognized it at that time. If the sinus had not healed he had intended to formalize.

Dr. A. P. C. ASHURST said that most patients with hydatid cyst, who are treated simply by evacuation and drainage have recurrences if they are traced long enough. Experiments have shown that every element of the contents of an hydatid cyst may be an infectious medium and hence the cause of recurrence. Quenu (1902) adopted the method of formalization, aspirating the cyst through a very fine needle and injecting the cyst until distended with one per cent solution which is allowed to remain for five minutes. After evacuation of the formalin, the cyst may be obliterated by sutures. No recurrences are to be anticipated after this treatment, and he believed if the method were better known it would be more used.

PARTIAL HYDRONEPHROSIS CAUSED BY PRESSURE FROM DOUBLE URETER

Dr. HENRY P. BROWN, Jr., presented a woman of twenty-eight years, who was admitted to the Gynecological Service of the Presbyterian Hospital, May 21, 1925, on account of pain in the left flank from which she had suffered for the past eight years.

This pain was referred to her left side, just below the twelfth rib in the posterior axillary line. The pain comes on irregularly every two weeks to six months and usually lasts from eight to twenty-four hours. It is quite

severe at times and causes her great distress. The pain does not radiate along the ureter, it always remaining localized. She has never taken morphia to relieve it. The attacks are gradually becoming more severe and more frequent, the most recent one having occurred one month ago and lasting twenty hours, the one preceding this having been about one month before. Urination was not painful and there was no frequency or urgency. Hæmaturia or pyuria had never been observed.

The sight of food causes nausea during an attack of pain, often accompanied by vomiting. There has been no gaseous eructations and no indigestion before or after the attacks. Bowels are regular without cathartics and there has been no blood or mucus in the stool, nor has she had any fever, chills or sweats.

She was a rather poorly developed, under-nourished visceroptotic type of young woman in no apparent distress, good color, no jaundice, dyspnoea or cyanosis, skin warm, smooth and moist without noteworthy lesions.

The head, neck and chest with their contents are essentially normal aside from a large pair of tonsils. The blood-pressure is 105/65. The abdomen is scaphoid and no masses or tenderness are elicited. The liver, spleen and kidneys are not palpably enlarged, and there is no costovertebral tenderness. Reflexes are normal and the extremities likewise negative.

The urine varied from 1010 to 1020 for specific gravity, albumin was never present and there were occasionally a few white blood-cells present. The blood showed red blood-cells 3,700,000, leucocytes 14,400 and hæmoglobin 74 per cent. Blood urea nitrogen was 18 mgs. P. S. P., first specimen of 110 cc.

showed 45 per cent, second of 90 cc. showed 20 per cent, a total of 65 per cent. Blood Wassermann was negative.

After repeated cystoscopic examinations with pyelograms and skiagrams the conclusion was reached that she had a movable left kidney with renal



FIG. 1.—Shows ureters untwisted. Cystic portion extends to line of branch of ureter on left.



FIG. 2.—Natural position showing constriction of ureter to lower segment.

colic from pelvic distention, without obstruction in the lower ureter when recumbent

May 5 1925 by the usual oblique loin incision, the kidney was exposed. It was found to be freely movable, contained a fair amount of fat in the pelvis, and was not very adherent to the peri-renal fat. It was readily exposed and found to be moderately enlarged and contained a large cystic mass in its lower two-thirds. The mass was aspirated and about four ounces of clear, mucous fluid was removed. The whole mass collapsed and there remained a small amount of kidney substance at the upper pole. The ureter was clamped and a pedicle clamp was applied to the vessels. The kidney removed and the ureter and vessels ligated. A cigarette drain was inserted and the wound closed. She made an uninterrupted recovery and was discharged on the sixteenth day after operation. At that time a P. S. P. showed first specimen 100 cc. with 25 per cent. second specimen 90 cc. with 15 per cent.

The laboratory report by Dr. John Finnan is as follows:

Specimen consists of a kidney 13.5 x 6.5 x 6 cm. Capsule strips fairly easily and leaves a pale reddish smooth surface. Fetal lobulations are fairly distinct. There are two ureters, one joining the other 2.5 cm. and 6 cm. respectively from the point of origin. The



FIG. 3—Sto. sex. with remnant of normal kidney tissue at upper pole. The pelvises did not communicate.

shorter limb of the ureter leads into a distinct funnel-shaped pelvis. The two ureters were twisted in such a way as to cause obstruction of the shorter limb. The dilated pelvis is continuous with an irregular cavity which roughly occupies little more than one-half of the kidney and must have been produced by back pressure of urine leading to dilatation of the pelvis, calices and atrophy of the renal substance. The longer fork of the ureter drains the other, upper, pole of the kidney. This part of the kidney shows no gross lesions. The two branches of the ureter communicate with two separate and distinct pelvises, hence the obstruction in one limb produced hydronephrosis in that portion of the ureter drained by the obstructed ureter.

Microscopically—Low-grade chronic interstitial nephritis and dilatation of the capsule of Bowman indicating effects of back pressure on all parts of the kidney.

For the privilege of operating upon and reporting this case, the reporter was indebted to Dr. E. B. Hodge, in whose service she was treated. A letter received from the patient ten days six months later, stated that she had never had a recurrence of her former trouble. "After leaving the hospital I rapidly regained my strength and have felt better in the last five months than in the preceding eight years. I have called myself cured."

DR LEON HERMAN thought that the pyelographic medium could not enter the dilated pelvis in this case, the ureter being completely obstructed. However, it is advisable in doing pyelography to withdraw the catheter slowly while the medium is being injected with which method one is more likely to demonstrate reduplications of the upper ureter. He preferred to block the lower ureter with a large catheter and inject the urinary tract with the patient in the Trendelenburg posture, this insures complete filling of the tract with the exception of those parts that are closed off. The presence of an abnormally small pelvic shadow in the pyelogram is always indicative of the presence of a congenital anomaly of the upper ureter and pelvis. If the presence of a small pelvis had been demonstrated in the case under discussion, the surgeon would have been quite justified in suspecting the presence of reduplicated pelvis.

As regards the possibility of partial resection in cases of double kidney, this will depend to a large extent upon whether the ureters have separate or communal blood supplies. In this case with high division of the ureter and the presence of a normal kidney on the opposite side, he thought the removal of the kidney was clearly indicated. The probabilities are that a resection would have resulted badly, the retained segment would in all probability have suffered gradual atrophy.

SOLITARY CYST OF KIDNEY

DR GEORGE M. LAWS presented a woman, age sixty years, who was admitted to the Presbyterian Hospital in April, 1924. She had a movable cyst in the right abdomen which was known to have been present for at least six years without much increase in size. During this time she had suffered from backache in both renal areas, worse lying down, and occasionally quite severe. The tumor was not tender. Vaginal examination excluded any connection with the pelvic organs. There were no urinary symptoms. Cystoscopic examination showed the bladder and ureteral orifices to be normal. There was no pelvic retention. Specimens of urine, collected by ureteral catheters, were practically identical on both sides showing a few leucocytes and excretion of approximately equal amounts of indigo-carmin. An ureterogram was made and the patient discharged the next day.

She was readmitted in April, 1925, having noticed an increase in the size of the tumor within four months, during which time she had had pains in both flanks, "like labor pains" every few days, and more recently severe pain in the thighs. X-ray showed calcification of blood-vessels and mild degree of osteoarthritis of the spine. Blood and blood chemistry were practically normal.

DR JOHN H. GIVIN operated through an abdominal incision and found the thin-walled cyst to be dark blue, about 4 inches diameter and its contents to be a clear amber-colored fluid. He did a transperitoneal nephrectomy which required the ligation of an aberrant artery at the upper pole of the kidney. Operative recovery was complicated by a temporary aphasia on the tenth day accompanied by high blood-pressure.

The diagnosis of cyst of the kidney having been confirmed by the ureterogram, showing displacement of the ureter, it seemed that polycystic disease could be excluded by the facts that the cyst was unilateral, that it developed

ABSCESS OF URACHIUS

late in life, had a smooth outline, kidney showed good function, no septa were shown by X-ray. As between solitary cyst and hydatid cyst the hydatid is described as fixed and non-fluctuating. Had a complement fixation test been done it would have helped to eliminate hydatid cyst and narrowed the possibilities down to a fairly positive diagnosis of solitary cyst. Furthermore the presence of advanced arterial sclerosis is a point in favor of solitary cyst since these formations are probably caused by sclerosis. However in the reported cases the diagnosis has rarely been made.

The specimen (fig. 1) consisted of a kidney $17 \times 8 \times 5.2$ cm. At one pole there is a cyst which has been opened and measures approximately 10 cm in diameter. The wall of the cyst is thin and on the inner surface shows dense fibrous tissue trabeculae. The inner lining is pale glistening and smooth. The cyst does not communicate with the pelvis of the kidney. The kidney is firm in consistency. Capsule is slightly but uniformly thick. The renal lobulations are fairly distinct. The capsule strips with difficulty and carries with it renal substance leaving a rather coarsely granular reddish to yellowish surface. Section does not bulge. Cortex measures 5 mm. Medulla about 17 mm. Color of the cortex and medulla is reddish to yellow. Renal vessels are markedly sclerosed and stand out like pipe-stems. There are excessive amounts of fat in the pelvis. The lining of the pelvis and calyces is for the most part smooth, pale and glistening. A few areas, however, show hemorrhages. At the pole opposite to that containing the cyst there is an aberrant artery.

Microscopic Examination. Simple solitary cyst of the kidney. Low-grade chronic interstitial nephritis and marked arterio-sclerosis.



FIG. 1.—Solitary cyst of kidney

ABSCESS OF URACHIUS

DR. ALEXANDER RANDALL presented a man forty-one years of age, who was admitted to the Philadelphia General Hospital September 26, 1919, on account of a swelling in the lower abdomen. He had had an attack of specific urethritis five months before, but the condition apparently cleared up under treatment without any complications, no history of any other serious illness or operations, urinary function has always been normal. Four or five days before admission he first noticed a painful swelling in the midline of the lower abdomen below the umbilicus, since then he had been increasingly indisposed, has had a fever, but no definite chill, has had some slight frequency of urination associated with terminal pain.

In the lower abdomen was found a large swelling situated between the symphysis pubis and the umbilicus, it is prominent to the eye and on touch is firm, rather fixed, round, smooth and tender, and is oblong in shape. It measures approximately 14×9 cm, the larger measurement in the longi-

tudinal axis of the body. There is no evidence of any connection or attachment to the bladder and the mass feels some larger and more superficial than a distended bladder would. The urine as voided by the patient contains shreds. Urinalysis negative, 1018. No stone felt in the bladder. Cystoscopic examination revealed an area of peculiar bullous oedema in the vertex of the bladder with a central area of increased hyperemia. In the actual centre of this was seen a pencil of white material hanging into the bladder cavity, which was waving back and forth by the flow of the irrigating fluid. It measured approximately $3\frac{1}{2}$ to 4 cm. in length by 6 or 7 millimetres in diameter and appeared similar to a pencil of tooth paste being squeezed from its tube. On this finding a diagnosis of infected urachus was made.

October 6, 1919, operation. An attempt was made to free the abscess mass in toto without opening up the peritoneum with an idea of complete bloc excision. However, as is usual in such urachal lesions, the walls were found to be exceedingly thin and their approximation to the peritoneum was intimate so that separation was impossible. A simple incision was therefore made and the cavity packed with iodoform gauze. Culture of the pus was subsequently reported from the laboratory as infected with Friedlander's bacillus.

The patient made an uneventful recovery except for an abscess in the scrotal wall which was opened and drained. Granulation of the large abscess cavity was slow and it was not until two months had passed that closure of the large drainage area had granulated completely. There was also a separation of the recti muscles and for this reason it was necessary to fit the patient with a proper lower abdominal belt to prevent an incisional hernia.

TUMOR OF URACHUS

DOCTOR RANDALL presented a man, aged thirty-nine years, who was admitted to the University of Pennsylvania Hospital, June 18, 1925, on account of pain at end of urination.

In August 1924, the man had an operation for hemorrhoids, since which time he claims not to have been free from pain. For three months this pain was located in his stomach, unrelated to meals, dull and continuous. In October, 1924, he first noticed pain at the end of the urinary act, which became sharp and burning, and at the same time he developed frequency of urination, having to rise two or three times each night. There was a slight terminal hæmaturia at times, but frequently a terminal pyuria. His upper abdominal pain left and a suprapubic soreness developed which was increased at the end of urination and radiated down the urethra. The pyuria seems to have been intermittent and the hæmaturia at no time severe, the symptom of pain was improved when the pyuria was present. During the last few weeks the onset of urination has been difficult and the amount of urine passed scant. He has lost ten pounds of weight during the past month. There have been no other local or subjective symptoms or signs.

Physical Examination—The general physical examination presents nothing of interest or bearing on his local condition. Rectal examination reveals a small, firm prostate which is not tender. Above the prostate pressure causes an increase in his hypogastrium pain. Following this examination the desire to void occurred and the patient passed three ounces of clear urine, followed by a small amount of pus. The end of the act was accompanied by an excruciating pain, which caused the patient to double up, and lasted for a period of a minute or more.

Cystoscopic Examination—The bladder contained no residual urine, had

PYELOGRAPHY IN RENAL DIAGNOSIS

a capacity of four ounces or more, bladder wall covered with normal mucous membrane except in the fundus, where was found a lesion situated in the neighborhood of four or more centimetres back of the interureteric bar. This lesion measures approximately 2.2 cm. in diameter; it is surrounded and bordered by healthy mucous membrane devoid of inflammatory reaction and appears as a shaggy brown mass bulging through a stretched and dilated orifice. The picture is one that suggests some extra-vesical body which is ulcerating its way into the bladder cavity.

Two diagnoses were suggested: 1st, a degenerated gumma of the bladder wall, 2nd, a foreign body. Bearing in mind the history of the patient having had an operation for hemorrhoids from which he dated the onset of his present complaint, it was thought possible that a sponge had been lost at that operation and was ulcerating its way into the bladder cavity. Efforts were made to obtain the details of this operation to determine whether or not it was a simple "clamp and cauterize" procedure or a more extensive resection such as a Whithead operation. These details could not be obtained. X-ray was taken of the bladder and showed a rather circular-shaped mass apparently extra-vesical and supporting innumerable trabeculi of calcareous character outlining the tumor mass.

June 28, 1925, operation. Suprapubic incision. As soon as the recti muscles were separated it was evident that the condition was one of uterine disease, an elongated tumor mass the size of a child's fist immediately being palpated. Realizing the close attachments of these tumors to the peritoneum, excision was started near its umbilical attachment, peritoneal cavity opened, the posterior bladder wall mobilized following the method of Voelker, and as soon as possible the peritoneum freed from the posterior bladder surface and the peritoneal cavity closed. The mass was resected from the summit of the bladder with 1.5 cm. of healthy mucous membrane about its periphery. The bladder was closed about a large mushroom catheter as a drain, and the abdominal incision closed about this. Convalescence was satisfactory, although healing of the wound unusually slow.

July 24, 1925. A catheter was placed in the bladder *per urethram*, and only by sidetracking the urine by this means was the bladder fistula closed three days later. The patient was discharged from the hospital August 21, he having been retained for a month in order to carry out deep X-ray therapy following suprapubic closure.

Description of Specimen (Doctor Bothé)—The mass measures $9 \times 5 \times 3$ cm. The surface is smooth and appears to be covered with a limiting membrane. At one or two points it is quite irregular and from one end oozes gelatinous material (apparently the intravesical area). On section it was found to be fairly firm due to fibrous bands and in between these fibrous bands are large deposits of colloid material. There are also scattered deposits of a calcareous nature. Microscopic section shows considerable mucoid material, some fibrous tissue and free blood. Scattered throughout are collections of epithelial cells, the general arrangement of which are glandular and these cells are large going from a cuboidal to a columnar type. The appearance of these cells is that of a malignant cell. Diagnosis: Mucoid carcinoma.

PYELOGRAPHY IN RENAL DIAGNOSIS

DR. LEON HERMAN read a paper with the above title, for which see page 227.

CORRESPONDENCE

INTESTINAL OBSTRUCTION FROM DIRECT TRAUMA

EDITOR ANNALS OF SURGERY

SII

Acute intestinal obstruction resulting from a general peritonitis caused by traumatism of various kinds is, of course, a more or less common occurrence, but acute obstruction caused by direct traumatism without the presence of infection and particularly obstruction which requires operative interference is of rather unusual occurrence. Traumatism of the intestines resulting from contusions of the abdomen and excessive manipulations during abdominal operations often does cause symptoms of obstruction, but the usual methods of procedure, morphine, poultices, etc., are practically always successful. Whether the paralytic ileus is due to a contusion of a segment of bowel or to a reflex phenomenon is a matter of conjecture and not a matter of vital importance. In either case there is an absence of infection. The following case it seems to me represents an illustration of this type of obstruction.

F. W., a factory engineer, fifty-six years of age, of fairly robust build, caught his left arm between the leather belt and the pulley over which it ran. He could not extricate it, and his body was dragged over the pulley before the machinery could be stopped. The case was first referred to Doctor McPherson, who found a compound comminuted fracture of the proximal end of the left ulna with an anterior dislocation of both the upper fragment and the head of the radius. The seventh, eighth, ninth and tenth ribs on the left side in the posterior axillary line were also fractured. Aside from a moderate degree of shock physical examination otherwise was essentially negative. A plaster bandage was applied to the arm and the left chest strapped with adhesive plaster.

For the following four days the patient presented no untoward symptoms, having about one degree of fever, a pulse of 80 to 90, of fair quality, and slightly accelerated respirations. His abdomen was noted to be somewhat distended, but soft. On the fifth day after his injury he began to complain of abdominal discomfort, which was relieved by the passage of considerable flatus, induced by poultices and low enemas. Vomiting of small quantities of brownish fluid began however, on the sixth day, and when seen in consultation at that time, the evident picture of an intestinal obstruction was presented. The facies was characteristic, but the abdomen, though markedly distended and tympanitic, was not particularly tender and there was no demonstrable flank dulness. The pulse was slightly accelerated, but temperature and respirations were practically as above noted, there was a leucocyte count of 17,800 with 80 per cent of polymorphonuclear cells.

The chest findings at this time were also interesting, clinically the signs over the left lower lobe posteriorly were those of a rather large cavity formation, roentgenologically the conclusions were a left-sided consolidation about a pulmonary abscess.

In spite of these findings the abdominal picture was, of course, an absolutely distinct entity. Although the cause of the obstruction was perhaps of minor importance in the determination of treatment, it was worthy of theoretical consideration.

The first thought naturally was a general peritonitis with paralytic ileus resulting from one of several possibilities.

1. From a small perforation through the diaphragm of either the ninth or tenth fractured ribs.

CORRESPONDENCE

2 From a small perforation in the intestine caused by the crushing injury which his abdomen must have directly sustained

3 A peritonitis due to the irritation from a slow hemorrhage from some viscus with secondary infection, this seems the least probable. Incidentally a mesenteric thrombosis could not be ruled out but it seemed a remote possibility. The pulse, temperature and blood count could all be easily accounted for by the lung abscess, to what extent might they be influenced by the abdominal condition was a matter for conjecture. As an alternative to the peritonitis theory was that of a paralytic ileus caused by a severe abdominal and intestinal trauma without the presence of any actual lesion, or better without the presence of infection. One strong argument against this theory would seem to be the fact that the ileus had not been relieved by medical means and that the man was dying from intestinal obstruction.

The treatment of the obstruction was obvious and simple—an enterostomy was performed under local anesthesia. On opening the peritoneal cavity about one ounce of clear serum escaped and a loop of distended, acutely red small intestine presented itself. A limited dorsal exploration of the abdominal cavity revealed no evidence of adhesions and as far as could be determined there was no perforation of the diaphragm. It was considered inadvisable to insert any drainage into the free abdominal cavity.

The subsequent course of the abdominal condition was quite satisfactory, liquid stools were passed on the eighth and soft solid excretions on the tenth days, the abdomen at this latter time being soft with no discation. After eight days of marked post-operative improvement in the patient's general condition a severe cough developed with the expectoration of pus and blood accompanied by a septic temperature and a fatal termination took place on the sixteenth day after the enterostomy.

At autopsy an abscess and extensive pneumonia of the lower lobe of the left lung were found, to which necrotic adhesions were attached and considerable exudate was present over the pleural site of the fractured ribs. The peritoneal cavity showed no evidence of peritonitis, the intestinal tract was negative throughout with the exception of the jejunal wound and its immediately associated pathology, namely the adhesive peritonitis plugging the gut to the abdominal wall and the somewhat contracted intestine just distal to the enterostomy. The diaphragm was also negative.

In summarizing the evidence in this case of general peritonitis *versus* direct trauma without infection as the cause of the intestinal obstruction we find that the most suggestive arguments against the former are, first the presence of simply clear serum in the peritoneal cavity on the sixth day after injury, second, the fact that cultures of this serum showed no growth, third the abdominal condition cleared up completely after operation, and fourth there was no evidence of peritonitis or intestinal or diaphragmatic perforation at autopsy.

There was no positive pathological evidence of direct trauma to the intestine but its absence does not exclude the diagnosis.

FRANCIS W. WORTHEN, M.D.,
Hartford, Connecticut

FIBROMA OF THE MESENTERY

EDITOR ANNALS OF SURGERY

Sir

Fibromata of the mesentery are reported with sufficient rarity to warrant the contribution of a single case.

Fibroma, a common connective tissue tumor, has been found so rarely in the intestinal mesentery that it has not been a subject of consideration by pathological texts, and has, as yet, been reported with insufficient frequency

for the establishment of an occurrence rate, either for mesenteric tumors or hospital admissions

A review of the literature, initiated by Greer¹ and completed and summarized by De Courcy and Maloney,² renders a total of not more than forty cases reported in one hundred years. This case corresponds to the analysis on the part of the above authors in (a) location, (b) symptoms based on partial obstruction and (c) occasional necessity for resection.

Mrs. I. H., age thirty-seven, white, complained of recurrent attacks of cramp-like pain in the right iliac region, accompanied by moderate constipation, considerable sense of weakness, gaseous indigestion and headache. These attacks had occurred over a period of a few years with increasing severity, lasting two to four days each time and usually exhibiting an interval of several weeks. The attendance of many physicians had given practically no relief but had resulted in bringing out that tenderness was present constantly over the appendix region.

Seen two days after the onset of an attack of pain, nausea and constipation, the patient exhibited an essentially negative physical examination except for marked tenderness, and production of nausea on pressure over McBurney's point. No roentgenological examination was made.

Operation under a diagnosis of "appendicitis" disclosed a normal-appearing appendix and a dense pale growth in the mesentery of the ileum about four inches from the ileocecal valve. The tumor was within the mesentery, in apposition to the intestinal wall and had puckered the ileum into a firm U-shape, with resultant obstruction to a slight degree. The character of the growth was not recognized in the gross, and a resection of about six inches of the ileum was done, followed by end-to-end anastomosis, and appendectomy.

The pathological report stated: Firm walnut-size tumor in mesentery, separated from wall of ileum by pad of fat. Microscopic structure, fibroma. Appendix normal. (Dr. W. P. Stow.)

The immediate recovery was uneventful and six weeks after operation the patient reported greater abdominal comfort than had been experienced for years.

WARREN WOOD, M.D.,
Rochester, N. Y.

¹ Greer. Brit. Med. Journ. 1911, October 28.

De Courcy and Maloney. Surg. Gynec. and Obstet., 1925, vol. 41, p. 402.

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INVASION OF THE INTRACRANIAL VENOUS SINUSES BY MENINGIOMA (DURAL ENDOTHELIOMA)

By EDWARD BANCROFT TOWN, M.D.

OF SAN FRANCISCO, CALIF.

FROM THE DEPARTMENT OF SURGERY, UNIVERSITY MEDICAL SCHOOL

The meningioma is an encapsulated tumor which compresses, but does not invade the brain, and which is not known to metastasize. It frequently invades the dura and the overlying cranial bone. If the involved dura and skull are removed at operation the tumor will not recur. Proliferation of the skull as a result of tumor irradiation is not a serious complication, provided that it is in a region accessible to surgery. In fact, it may call attention to the possibility of an underlying tumor compressing a "silent" area of the brain.

Meningiomas arise from nests of arachnoid cells, and very commonly from those which accompany the arachnoid villi which pierce the dura and project into the venous sinuses. It would seem, therefore, that a tumor arising from the cells of a villus might invade the vein. Cushing¹ has reported such a case. The tumor which arose from the wall of the superior longitudinal sinus invaded the vein without thrombosing it. As no other example of venous invasion has been found in the literature, it seems advisable to record two instances of this condition. In the first case the extent of the growth in the venous system is unknown, as the invasion of the sinus was an operative finding, but in the second case necropsy showed very extensive invasion of the venous system, and secondary growth through the walls of the occluded veins into the surrounding tissues. In this and perhaps in the first case, the involvement of the blood-vessels precluded the possibility of complete surgical removal of the tumor.

CASE REPORTS

CASE I—*bilateral parasagittal meningioma compressing the frontal lobes, proliferation of the overlying skull, invasion of the superior longitudinal sinus. Removal in two stages. Death three months later. No necropsy.* R. Z., a man aged thirty-two years married a laborer, entered the Neurological Ward of Lane Hospital, March 15, 1923, complaining of failing vision.

History—He had been working as a logger until two weeks before admission. Eight years previously he had received a blow in the midfrontal region. He believed that the swelling on his forehead was the result of this injury. The right side of the face had been numb for four weeks. Dimness of vision, especially in the right eye, had been noticed for three weeks. There had been no headache, double vision, nausea or vomiting.

¹ Cushing, Harvey. The Meningiomas (Dural Endotheliomas). Their Source and Favoured Seats of Origin. *Brain*, 1922, vol. xlv, p. 282.

for the establishment of an occurrence rate, either for mesenteric tumors or hospital admissions

A review of the literature, initiated by Greer¹ and completed and summarized by De Courcy and Maloney,² renders a total of not more than forty cases reported in one hundred years. This case corresponds to the analysis on the part of the above authors in (a) location, (b) symptoms based on partial obstruction and (c) occasional necessity for resection.

Mrs. I. H., age thirty-seven, white, complained of recurrent attacks of cramp-like pain in the right iliac region, accompanied by moderate constipation, considerable sense of weakness, gaseous indigestion and headache. These attacks had occurred over a period of a few years with increasing severity, lasting two to four days each time and usually exhibiting an interval of several weeks. The attendance of many physicians had given practically no relief but had resulted in bringing out that tenderness was present constantly over the appendix region.

Seen two days after the onset of an attack of pain, nausea and constipation, the patient exhibited an essentially negative physical examination except for marked tenderness, and production of nausea on pressure, over McBurney's point. No roentgenological examination was made.

Operation under a diagnosis of "appendicitis" disclosed a normal-appearing appendix and a dense pale growth in the mesentery of the ileum about four inches from the ileocecal valve. The tumor was within the mesentery, in apposition to the intestinal wall and had puckered the ileum into a firm U-shape, with resultant obstruction to a slight degree. The character of the growth was not recognized in the gross, and a resection of about six inches of the ileum was done, followed by end-to-end anastomosis, and appendectomy.

The pathological report stated: Firm, walnut-size tumor in mesentery, separated from wall of ileum by pad of fat. Microscopic structure, fibroma. Appendix normal. (Dr. W. P. Stowe.)

The immediate recovery was uneventful and six weeks after operation the patient reported greater abdominal comfort than had been experienced for years.

WARREN WOOD, M.D.,
Rochester, N. Y.

¹ Greer. Brit. Med. Journ., 1911, October 28.

² De Courcy and Maloney. Surg. Gynec. and Obstet., 1925, vol. 41, p. 402.

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Examination—In the midfrontal region there was a large tumor (Fig 1) which extended farther to the left than to the right. The overlying scalp was freely movable. The scalp veins in the frontal and temporal regions were markedly enlarged. The tumor was hard peripherally and soft centrally, without pulsation or fluctuation. Rontgenograms of the skull showed peripheral proliferation and central destruction of the involved bone. The sense of smell was not impaired. Visual acuity of the right eye was 20/50, and of the left, 20/100. There was bilateral papilloedema of three to four diopters, with some secondary pallor. The right pupil reacted normally to light, and movements of the right globe were not restricted. The left pupil was dilated and reacted only slightly to light, and there was weakness of the left internal rectus muscle. Sensation was absent in the cornea and in the distribution of the superior maxillary branch, and diminished in the remainder of the territory of the right fifth nerve. The motor portion of the nerve was normal. The remaining cranial nerves were normal. Examination of motor and sensory functions and reflexes showed nothing abnormal. Memory and orientation were slightly impaired. Wassermann reactions on the blood and spinal fluid, and all other laboratory tests, were negative.

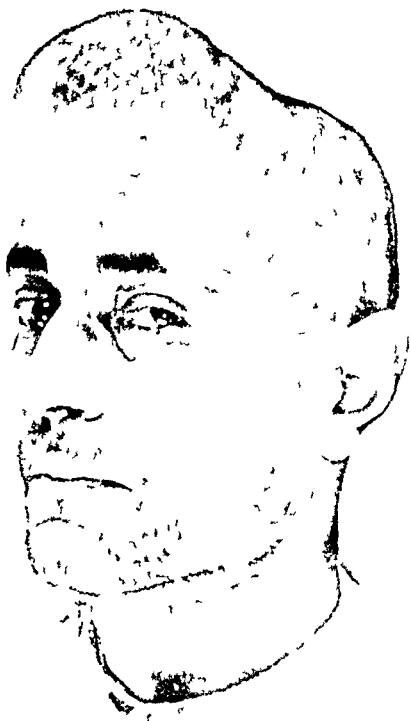


FIG 1—Case 1. Photograph of the patient.

First Operation—March 19, under local anesthesia, the extradural tumor was removed. It did not invade the epicranial aponeurosis. The demarcation between normal and invaded bone was distinct, the latter was thickened, soft and red. The central portion of the extradural mass was firmly attached to the underlying structures, and had to be cut free. In an area about 4 cm. in diameter, to the left of the sinus, the dura was replaced by soft tumor. A transverse section of the mass, which weighed 285 grams, showed that the bone was not entirely destroyed at the centre, and that the bulk of the mass was soft tumor lying between the bone and the epicranial aponeurosis (Fig 2). Microscopic examination showed typical meningeal tumor in the diploic spaces of the bone. Four days after operation patient became irrational, with alternating periods of terrifying hallucina-

tions and of euphoria. During week that psychosis lasted general condition was excellent.

Second Operation—April 9, the intradural tumor was removed under general anesthesia. Dural involvement was so extensive that the membrane was removed almost to the edge of the bone defect. About two-thirds of the tumor lay on the left side of the falx (Fig 3). It was nodular, soft, reddish-brown in color, and quite adherent to the pia. The superior longitudinal sinus was ligated at either end of the mass. The sinus, when cut through, was seen to be filled with soft, yellowish tissue (Fig 4) which was thought to be organized clot following the first operation. The intradural tumor weighed 143 grams and measured 11 by 9 by 5 cm. Sections of the superior longitudinal sinus showed that the supposed clot was actually meningioma, which filled and occluded the sinus throughout the excised portion. The wall of the vein was invaded, and the tumor within the sinus was continuous, in many places, with that infiltrating the surrounding dura. The tumor cells were spindle-shaped, and had a marked tendency to form whorls, many of which were fibrous, and a few calcified.

MENINGIOMA INTRACRANIAL SINUSES

The patient's condition was satisfactory for a week, after that he began to fail, both physically and mentally. He died on June 12, 1923, two months after the second operation. Necropsy was not obtained.

CASE II—*Meningioma of the falx cerebri, invasion of the inferior longitudinal sinus, extension into the straight, superior longitudinal, right and left lateral sinuses, left internal jugular and innominate veins, and superior vena cava. Secondary invasion of perivascular tissues. Sudden death. Necropsy.* L. T. a woman aged fifty-four years, married, a housewife, entered the medical ward of Lane Hospital, March 20, 1925, complaining of nervousness, irritability, loss of interest, pains in the chest, and dry cough.

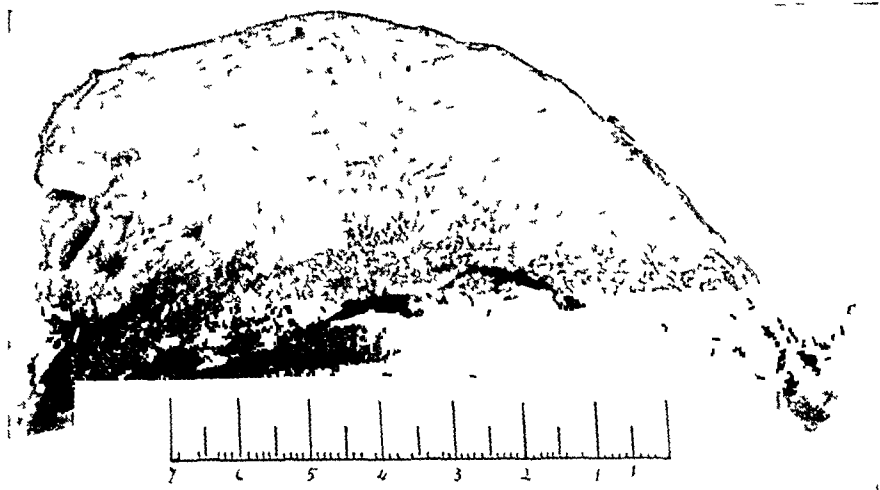


FIG. 2—Case I. Transverse section of extradural tumor.

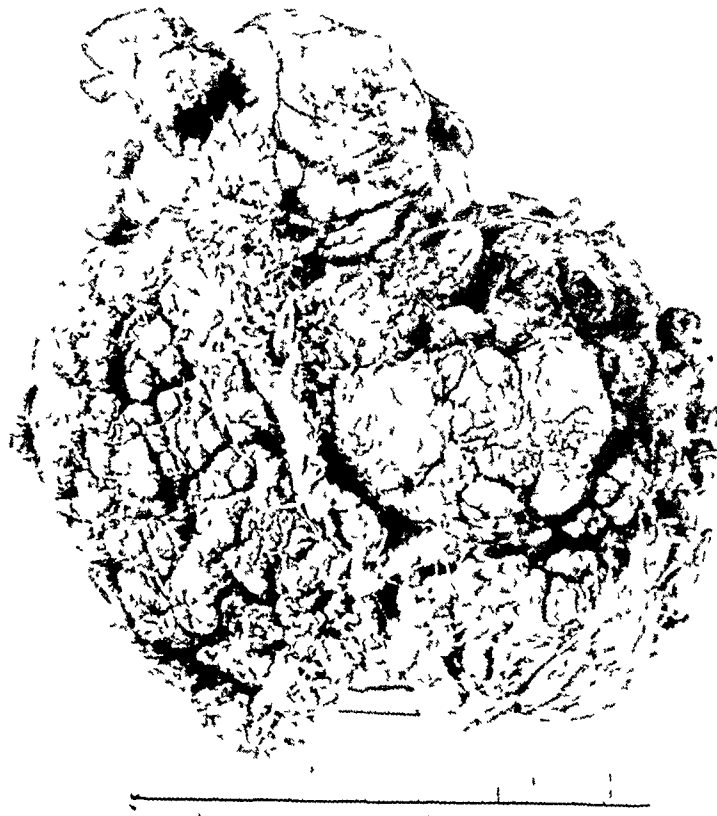


FIG. 3—Case I. Inferior aspect of intradural tumor.

History—She had been exceptionally well until a year before admission. She had six living and healthy children. A small tender mass appeared in the left side of the neck early in 1924. The tumor was removed in July, 1924. Dr. Frederick Proesch, of San Jose, kindly furnished the following pathological report: "Tumor 8 by 2 by 1 cm., of a firm consistency and covered by a smooth capsule. On section, the cut surface was smooth, and grayish-white to grayish-red in color. Microscopically, it consisted of spindle-shaped cells arranged in strands and whorls. Some of the whorl formations contained a colloid-like substance. Here and there were a few gland-like structures with a distinct lumen,

lined with a single layer of cylindrical epithelial cells. Diagnosis: Endothelioma of the carotid gland." The patient received eleven Röntgen-ray treatments. She became nervous, irritable and depressed, with loss of ambition and enthusiasm. She was easily

upset, and often wept without cause. For three months she had been troubled by an unproductive cough. There had been no headache, vomiting or visual disturbances.

Examination—A well-nourished woman of apparently normal intelligence. The pupils were equal, and reacted to light and in accommodation. Movements of the eyeballs were normal. Watch tick was heard on the right at a distance of 3 feet, and not heard on the left. There was a linear scar, 2 inches long, running downward from the angle of the left jaw. Examination of the heart, lungs and abdomen showed nothing abnormal.



FIG 4—Case 1. Posterior aspect of intradural tumor. Superior longitudinal sinus filled with tumor.

The blood-pressure was 160/90. The elbow and knee-jerks were active and equal. Blood examinations and urinalysis were negative. The temperature was 98.6, the pulse rate 64, and the respiratory rate 18. This was the complete record, except the spinal fluid examination.

The interne's preliminary diagnosis was involuntary melancholia.

A spinal puncture was done March 21 at 10 A.M., with the patient in the sitting posture. The amount removed was 10 cc. The cell count was less than 1 per cmm, and the Wassermann, Nonne and Noguchi reactions were negative. The patient vomited several times during the afternoon and night. At 8 A.M., March 22, she complained of a severe headache. At that time the pulse was



FIG 5—Case 2. Tumor between cerebral hemispheres deforming the right hemisphere. Indentation of left occipital pole and of cerebellar hemispheres by pressure of secondary intradural nodules.

64, the respirations 18, and both were regular. At 8.15 she was unconscious, with a weak, irregular pulse and rhythmic respirations. After a period of artificial respiration the heart stopped. It beat again for ten minutes following the injection of 1 cc of epinephrin into the left ventricle, but a second injection had no effect.

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Necropsy—The examination was negative except for the following findings. There was a thin subdural clot over both frontal lobes, and a subpial extravasation at the right occipital pole. The convolutions of the cerebral hemispheres were markedly flattened. Attached to the falx cerebri was a tumor measuring about 6 cm in all diameters (Fig 5), which made a deep indentation in the postero-mesial aspect of the right cerebral hemisphere, without invading the pia-arachnoid. The surface of the tumor was rough. Its inferior aspect was adherent to, but did not invade, the corpus callosum. The tumor was attached, over an area measuring 1.5 by 2 cm, to the right wall of the inferior longitudinal sinus and to the falx, just in front of the junction of the falx and the tentorium cerebelli.

The tumor was broken when the dura was removed, the portion attached to the falx is shown at A in Fig 6. This part of the tumor extended up alongside the superior longitudinal sinus, but its attachment was only along and adjacent to the inferior longitudinal sinus (Fig 7).

The inferior longitudinal sinus posterior to the point of attachment, and the straight sinus, were filled with tumor which was firmly adherent to the wall of the veins. The straight sinus emptied into the left lateral, and the superior longitudinal into the right lateral sinus. The con-



FIG 6—Case 2. Inferior aspect of dura. Left side of tentorium cut. A, primary tumor attached to falx. B and C, secondary nodules above and below tentorium.

fluence of the sinuses was filled with tumor, which here broke through the sinus walls in four directions, forming three intradural and one extradural masses. The intradural nodules were 1.5 to 2.5 cm in diameter, and lay in the angle between the left aspect of the falx cerebri and the tentorium, and, below the tentorium, on either side of the falx cerebelli (Fig 6, B,C). These nodules caused small depressions in the left occipital pole and in both cerebellar hemispheres (Fig 5). The extradural invasion lay directly over the torcular and perforated the skull, forming an eroded area 1.5 cm in diameter.

The tumor in the sinuses extended from the confluence in three directions: (1) completely filling the posterior portion of the superior longitudinal sinus (Fig 7) to a point 3 cm from the torcular, anterior to which the sinus was empty, (2) partly filling

the right lateral sinus for a distance of 5 cm from the torcular, and (3) completely filling the left lateral sinus. Just posterior to the petrous portion of the left temporal bone the tumor broke through the outer wall of the sinus and invaded the skull. The left internal jugular vein (Fig 8) and the left innominate vein were filled with tumor.

The tumor extended a short distance into the superior vena cava, but did not obliterate its lumen.

Microscopic Examination—The tumor cells were spindle-shaped, and showed a marked tendency to form whorls. Some whorls were made up entirely of cells, some surrounded small blood-vessels, some showed hyaline degeneration at the centre, and a few were fibrous or calcified. In the jugular vein the cells were arranged in bands, resembling a sarcoma, and rarely formed whorls. Mitotic figures were common. In places there were multiple mitoses, resulting in giant cells. The supporting stroma was scanty and very vascular. The intradural tumors, and some of the intravenous tumor, had a thin fibrous capsule. Other portions of the intravenous tumor, as in the straight and left lateral sinuses, had no capsule,

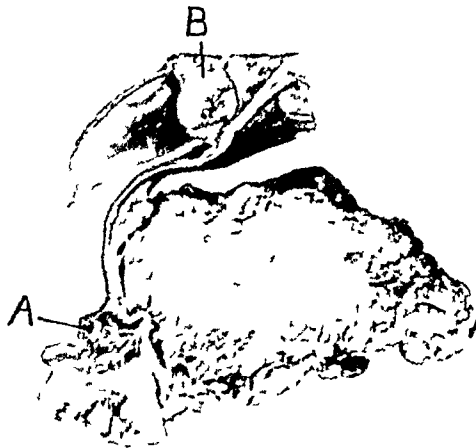


FIG 7—Case 2. Transverse section through attachment of tumor to wall of inferior longitudinal sinus, A. B, superior longitudinal sinus filled with tumor.

here the tumor cells invaded and sometimes broke through the wall of the vein. In places, encapsulated masses of tumor cells grew out, like buds, from the adventitia of the vein (Fig 9). The cervical lymph-glands did not show tumor invasion. In the superior longitudinal and right lateral sinuses the method of extension of the tumor could be studied. The process was one of invasion of organizing thrombus by tumor cells (Fig 10), with the formation of a limiting capsule which temporarily separated the tumor from the intima of the vein.

It is interesting to speculate whether the tumor removed from the neck in 1924 was an ex-

tension of the process which was later found to involve the left jugular and innominate veins. Doctor Proeschel's description of the histology corresponds closely with our findings, except that we did not see any gland-like structures lined with cylindrical epithelial cells.



FIG 8—Case 2. Transverse section of left internal jugular vein filled with tumor.

MENINGIOMA INTRACRANIAL SINUSES

SUMMARY

Meningiomas, or dual endotheliomas, are encapsulated tumors which do not invade the cortex, but which frequently invade the dura and the overlying cranial bone. They arise from nests of arachnoid cells which often lie on the arachnoid villi, which project into the intracranial venous sinuses. Theoretically, meningiomas might invade the venous sinuses of the dura. Only one example of invasion, without occlusion of the sinus, has been found in the literature. Two additional cases are reported.



FIG 9—Case 2 Photomicrograph $\times 13$ Encapsulated mass of tumor budding off from adventitia of internal jugular vein

In one, the superior longitudinal sinus was occluded. In the second, a meningioma had invaded the inferior longitudinal sinus and grown extensively in

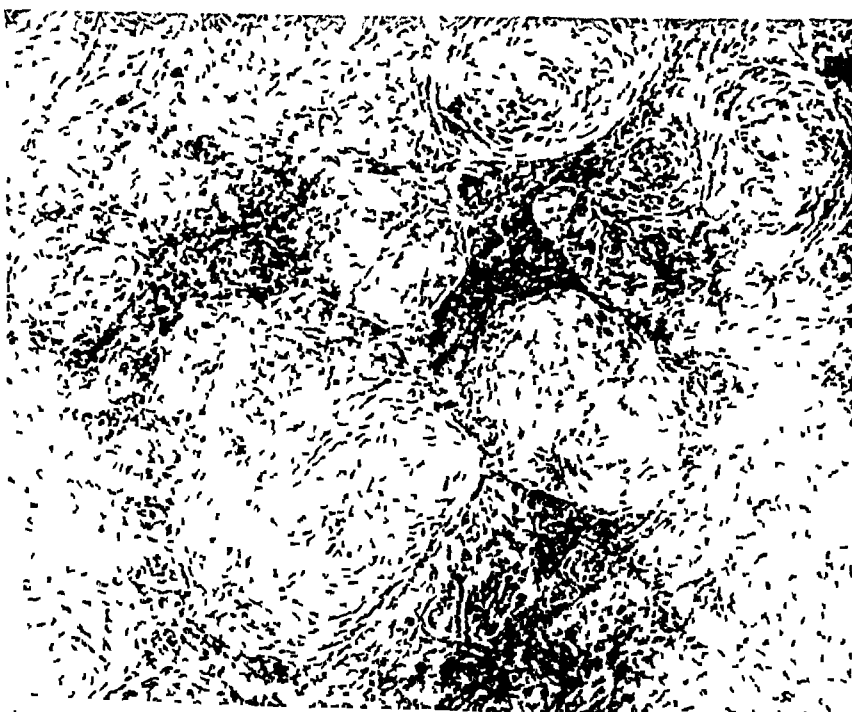


FIG 10—Case 2 Photomicrograph $\times 110$ Tumor cells invading organizing thrombus in superior longitudinal sinus

the venous system, terminating in the superior vena cava. The tumor had secondarily invaded and broken through the venous walls in many places.

Such invasion of the venous system may convert a meningioma, which is otherwise favorable for surgical treatment, into an irremovable

tumor. The surgeon should examine the adjacent venous sinus for possible involvement when the tumor is attached to the dura. Necropsy in the second case suggested that an early intravenous extension, before secondary invasion of the wall of the vein, might be successfully excised.

GIANT-CELL TUMOR INVOLVING PHALANGES

BY WALLACE H. COLE, M.D.

OF SAINT PAUL, MINN.

IN THE ANNALS OF SURGERY for April, 1925, Veimooten reported a case of giant-cell tumor of the thumb, of the xanthosarcoma variety (Following Ewing's classification) The rarity of such tumors in the phalanges was dwelt upon, as a review of the literature seemed to show only one other reported case and that was a giant-cell tumor, of the epulis type, in the

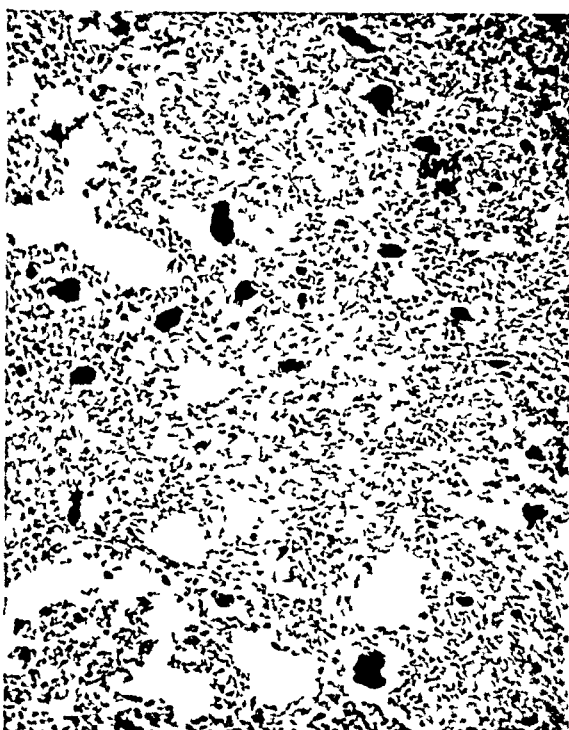


FIG. 1.—Photomicrograph of giant-cell tumor of proximal phalanx of toe cured by amputation

terminal phalanx of a toe, reported by Bloodgood. A new search of the literature by the present author has failed to reveal any additional reports, but personal observation adds two cases to the list. One of these involved the proximal phalanx of a toe and the other the proximal phalanx of a thumb, both of the growths being typical giant-cell tumors or, following Ewing's classification, the epulis type of giant-cell sarcoma. These tumors can not be as rare as the literature suggests and it must be that the failure to report cases leads to this false assumption. In Beitzmistle's book of Radiography there is a reproduction of a plate (No. 162), with a diagnosis of myeloma, which

case probably belongs to this group, but no history or pathological findings are given, so it can not be accepted as authoritative. The cases to be reported follow.

CASE I.—Mrs. A. W., a woman twenty-seven years of age, Italian, reported at the hospital in April, 1920, on account of discomfort in the fourth toe of her left foot of two years' duration. During this time there had been gradual enlargement of the base of the fourth toe and intermittent pain was present after use of the foot in walking or standing.

Examination showed a soft, almost fluctuating mass involving the proximal phalanx of the second toe with apparent enlargement of the phalanx. There was no tenderness and apparently no joint involvement. The roentgenograph showed a rarefying and expanding lesion of the proximal phalanx of the second toe with a breaking through of the cortex. A diagnosis of tumor or tuberculosis was made.

April 16, 1920, the toe was amputated. The pathological report on the specimen was

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"Tumor involves the marrow of the proximal phalanx of the toe and presents outside the bone dorsally as a lobulated tumor about $3 \times 1 \times 1$ centimetres. The tumor is soft and red. Microscopic section shows a typical giant-cell tumor" (Fig 1) The ampu-

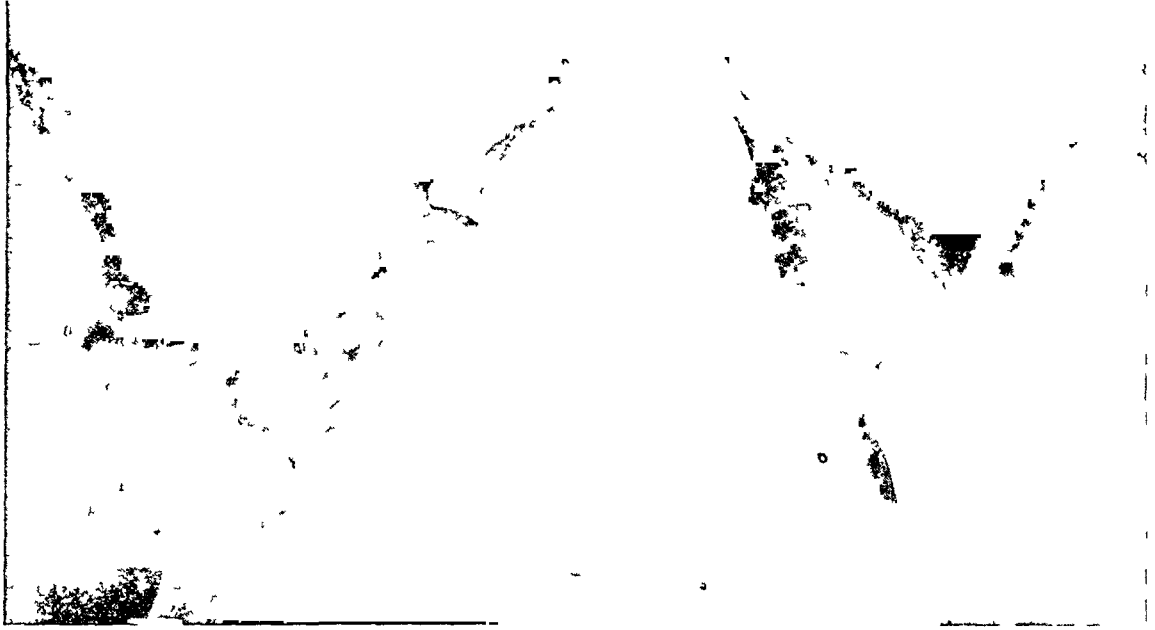


FIG 2 —Rontgenogram of giant-cell tumor of proximal phalanx of thumb, lateral view

tation wound healed normally. Patient was last seen in November, 1925—five and a half years after operation—and is apparently well, there being no signs of local or glandular recurrence of the tumor.

Unfortunately, the roentgenological plates were destroyed and the gross specimen lost.



FIG 3 —Rontgenogram of giant-cell tumor of proximal phalanx of thumb antero-posterior view

at the hospital, so that the microscopic section only is preserved. An examination of Fig 1, which is a photomicrograph of a portion of this section, can leave no doubt that the diagnosis of a benign giant-cell tumor was correct.

CASE II—Mrs K, a woman fifty-four years of age, reported for examination on August 9, 1924, complaining that the right thumb was swollen but not painful and that her family physician had diagnosed the condition as an osteomyelitis and had prepared to operate and probably amputate the thumb. The swelling started without any apparent cause, in October, 1923. There was no pain and the only treatment undertaken was to paint the thumb with iodine. It was noticed very early that the thumb was tender and

that it could not be used as freely as before. A splint was used on the thumb for a short time without any relief from the swelling or tenderness. The condition apparently had been stationary for the three months preceding the examination. The history otherwise was absolutely negative and a thorough examination at one of our large clinics, some time previously, was reported negative.

Examination showed a definite thickening of the right

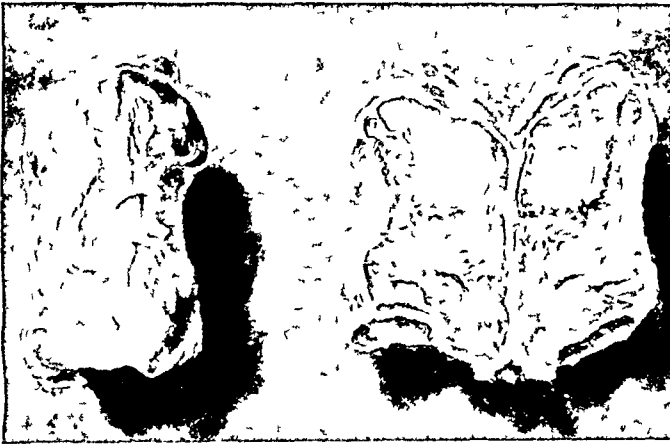


FIG 4—Drawing of gross specimen of resected phalanx of thumb the seat of a giant-cell tumor

thumb in the region of the proximal phalanx. Measurements showed a two centimetre increase in circumference around this portion of the thumb, as compared with the left thumb. There was slight tenderness on deep pressure over the swelling and the swelling seemed to be bony in consistency. No crepitation was elicited. The distal joint was held straight and only about five degrees of motion was possible in the direction of flexion. There was also a slight

limitation of motion in the metacarpophalangeal joint. A roentgenological examination showed the proximal phalanx of the thumb enlarged by expansion but with definite areas of bone destruction, especially in the distal one-half and with bony trabeculae running through the base (Figs 2 and 3). A diagnosis of bone cyst or giant-cell tumor was made and operation advised.

Operation August 14, 1924. A rubber-band tourniquet was applied to the base of the right



FIG 5—Photomicrograph of giant-cell tumor of proximal phalanx of thumb

thumb. Through a dorso-lateral incision the proximal phalanx of the thumb was exposed and removed *en masse* without cutting into the tumor mass at any point. The bony cortex was found completely destroyed at the distal end of the phalanx and there was a bulbous projection of tumor at this point, which was firmly encapsulated. A small piece of bone was resected from the right tibia and covered with periosteum.

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on all sides and one end. This graft was then wedged into the distal end of the metacarpal bone of the thumb which had been split to receive it, the end covered with periosteum resting against the proximal end of the distal phalanx. The graft was easily held in place and the deep and subcutaneous tissues were closed with fine formalized catgut. No splint was applied but a voluminous dressing kept the part immobilized.

The pathological report was as follows: "Tumor of thumb occupies the distal end of the middle phalanx and reaches down into the shaft for a distance of 0.5 centimetre and extends over the entire width of the bone (Fig 4). It consists of soft, red tissue which is moderately firm in consistency. Microscopic sections show it to consist of large numbers of giant cells, surrounded by a fibrous tissue which is adult in type

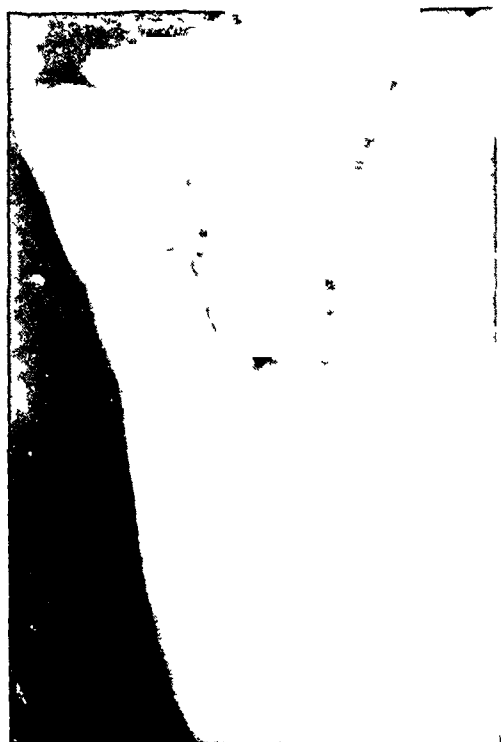


FIG 6—Röntgenogram of thumb five weeks after replacement of proximal phalanx by graft from tibia. Union with the metacarpal is apparently taking place.



FIG 7—Röntgenogram of thumb six months after replacement of proximal phalanx by graft from tibia. New bone is of the same density as the metacarpal.

and not very cellular (Fig 5). The cells are oval and quite similar to fibroblasts which are nearing maturity. On the edge are very many small spicules of bone between which is the same cellular tissue and the giant cells as in the main tumor, and this evidently represents the advancing edge of the growth. Occasionally a mitotic figure is seen, but these are not numerous enough to put the tumor into the malignant class, and the rest of the stroma does not at all suggest malignancy. Diagnosis: Giant-cell tumor of bone of thumb."

The post-operative convalescence was uneventful and the stitches were removed on the tenth day at which time the wound was completely healed. An attempt was made to get motion in the distal phalanx, starting at this time, but only a slight give was permissible. On September 20, examination showed the graft to be apparently firm and a röntgenological examination seemed to show that the bone was becoming firmly attached to the metacarpal (Fig 6). In October, a leather thumb support was made in order to further protect the graft and the patient was instructed to use the thumb as freely as possible. On February 5, 1925, six months after the operation, the thumb could be used very freely, although of course the metacarpo-phalangeal joint was absent. The distal joint of the thumb had not regained any motion and the ultimate result was practically a stiff but very serviceable thumb. Röntgenograms showed the graft undoubtedly alive and growing (Fig 7).

Although it is too soon to state definitely the ultimate outcome in this case, it is felt that certain facts seem to be clear. Giant-cell tumors of the type here found are beyond doubt benign and curable by complete local removal, and it is therefore reasonable to expect that no further trouble will arise in this case as a result of the presence of tumor tissues itself. The bone graft is certainly alive, or at least has been replaced by live bone, for the roentgenological picture shows this fact definitely. Whether the surgical procedure in this case was that of choice is probably a debatable point, but it was certainly impossible to remove the tumor entirely by any other means than resection of the phalanx. The gap remaining might have been filled by allowing the distal phalanx to fall back against the metacarpal in a manner similar to that used by Codman in a finger, as reported by Bloodgood. The amount of soft tissue which had to eventually contract or absorb was so great however, that this method, if used, would undoubtedly have assured a rather useless thumb. The graft from the tibia as used appeared to be the safest procedure and the functional result obtained bears out that judgment.

SUMMARY

Two cases of benign giant-cell tumor of the phalanx are reported. The first of these involved the proximal phalanx of a toe, and is cured five and one-half years after amputation. The second involved the proximal phalanx of the thumb. This patient was well sixteen months after the phalanx was resected and replaced by a bone graft from the tibia, driven into the metacarpal head. The result is a stiff, but very serviceable, thumb.

PERI-ARTERIAL SYMPATHECTOMY

REPORT OF THREE CASES IN WHICH IT FAILED

BY NATHAN WINSLOW, M.D.

OF BALTIMORE, MD

FROM THE SURGICAL DEPARTMENT OF THE UNIVERSITY OF MARYLAND

To LERICHE belongs the credit not only of being the first to suggest, but also of being the first to apply peri-arterial sympathectomy in the treatment of the rebellious forms of tropho-neuroses. The operation is simple. It is without danger. It requires no elaborate technic and it is easy to execute. As devised by Leriche, it consists of (1) exposure of the selected artery by an appropriate route, (2) removal of $1\frac{1}{2}$ to 2 inches of the loose areolar tissue from the tunica adventitia. Step two is the essential portion of the operation and is accomplished by making encircling incisions around the vessel at the upper and lower limits of the site chosen for the dénudation and by connecting these with a conveniently placed vertical incision. It is of the utmost importance that none of these cuts dip too deeply into the arterial wall, else a traumatic aneurism may result. The tissue thus outlined is now stripped off the tunica adventitia in thin slices or in a single piece, either by blunt or sharp dissection, thereby severing the sympathetic nerves lying beneath it and coursing along the artery. This break in the continuity of the peri-arterial sympathetic plexus is followed according to Leriche by a dilatation of the vascular tree distal to the decorticated area and by an increased blood supply, with a coincident improvement in the nutrition to the affected parts. It is to these effects that he ascribes the beneficial action of the operation. Up to 1921, he had performed this operation on 64 patients, for the following conditions: ¹

Causalgia, 11 times, painful stumps, 2 times, post-traumatic contractures, 19 times, trophœdema, 1 time, post-traumatic cedemas, 4 times, ischæmia, 4 times, trophic slough on stump, 1 time, trophic slough after nerve section, 10 times, trophic slough of heel after medullary injury, 1 time, varicose eczema, 1 time, trophic trouble after frost-bite, 1 time, spasmodic paralysis, 1 time, to modify tension of cerebrospinal fluid, 3 times, Jacksonian epilepsy, 2 times, goitre, 1 time, intermittent claudication, 1 time, erythromelalgia, 1 time.

In some instances he obtained remarkable successes, and on other occasions he had complete failures. The operation failed in the case of intermittent claudication, in one case of trophic trouble after frost-bite, in one case of spasmodic paralysis, and in some cases of painful syndromes like erythromelalgia. In nine cases of causalgia after war wounds, he reports, two failures, two improvements and five excellent results. In certain painful cases preceding gangrene caused by endarteritis obliterans with or without

¹Leriche ANNALS OF SURGERY, Phila., 1921, vol. LXXIV, p. 385

intermittent claudication, it has given the same good results as in painful acroparaesthesia, consecutive to bruising of a finger, to wounds of the hand, palm, or sole of the foot. He performed it twice in Raynaud's disease, with satisfactory results. In painful stumps, it gave one success and one failure. In three cases of trophœdema, a rapid diminution of the œdema resulted. In trophic diseases leading to œdema, arterial decortication proved very efficacious, twelve out of thirteen cases were followed by rapid healing. In some cases of trophic lesions consecutive to a section of a nerve, the results were excellent. In ten such cases he obtained rapid healing of the ulcer.

Farther on in the same article, he says, the post-operative vasodilatation being lasting, peri-arterial sympathectomy can be utilized to help the insufficient circulation, for instance, in endarteritis obliterans.

The literature contains a number of papers by thoroughly competent and reliable observers extolling the virtues of arterial decompression. With the testimony of such witnesses the procedure must have a measure of value when applied to properly selected cases. The big question is, what cases may be considered as coming under this category? As yet too few adverse reports have found their way into print to serve as a starting point for the solution of this problem. The following case histories represent the experience of the surgical staff at the University of Maryland with the operation.

CASE I—The patient, a white male, age thirty-six, entered the hospital, March 9, 1924, with a beginning gangrene of the right foot. Four years previously, he had had his left thigh amputated for thrombo-angitis obliterans. Some six months before he had begun to suffer with pain in his right foot. This increased gradually in severity and at times for the preceding three months had been almost unbearable. It was worse at night and exaggerated by exercise. Occasionally the foot had become greatly swollen, without apparent cause. Examination revealed a decidedly purplish mottling of the foot. When elevated the foot became pale and on lowering cyanotic. It was tender and very painful. Its anterior half was of a dusky red color, but not swollen. Passive motion increased the pain and blanched the foot, when stopped the capillaries refilled rapidly and the foot quickly assumed its erstwhile cyanotic hue. Heat or cold when applied to the foot, caused intense pain. The diagnosis was gangrene of the toes consecutive to a thrombo-angitis obliterans.

On March 12, 1924, the popliteal artery was exposed at its upper third and a circumferential layer of areolar tissue peeled off the tunica adventitia for a length of two inches. For a few days, it looked as though the operation had accomplished some good. The pain was less severe and the foot appeared warmer. The improvement was, however, quite fleeting, and the symptoms then returned with greater severity than ever. Fearing that the intervention had not been done at a sufficiently high level, the operation was repeated, April 15, 1924. This time the incision was made through Scarpa's triangle and the common femoral artery denuded with a technic exactly similar to that employed above, but with results equally as unsatisfactory. Owing to constantly increasing symptoms on May 10, 1924, a mid-thigh amputation was performed. The pathologist reported that specimens taken from the femoral artery showed extensive thickening of the arterial wall, thus confirming the clinical diagnosis of thrombo-angitis obliterans. After both of these operations, the femoral and popliteal arteries contracted down to half their original size and ceased to pulsate below the site of ligation, thus conforming to the signs of a properly executed operation as laid down by Ieriche.

PERI-ARTERIAL SYMPATHECTOMY

CASE II.—The patient, a white male, age thirty-eight, was admitted to the hospital, February 26, 1924, for Raynaud's disease of the left foot. In June, 1923, he had had the large and small toes of this foot amputated for gangrene. From that time he had constantly suffered with what he described as a drawing sensation in his left foot. It was constant and present both day and night, but of equal intensity. It was less noticeable when walking. The foot had periods of alternate heat and cold. The big and little toes were missing. The second toe was purplish in color. On the under surface at the extreme tip of the distal phalanx was a small opening from which an occasional drop of pus escaped. The blood Wassermann was negative. Examination of the spinal fluid gave a positive globulin reaction, a cell count of two, and a negative Wassermann. The gold curve was of normal type. The condition was diagnosed as Raynaud's disease and a peri-arterial sympathectomy suggested.

Accordingly on March 1, 1924, a vertical incision was made in Scarpa's triangle, the common femoral artery exposed, and denuded for a distance of two inches. Here again, the artery contracted at the operative site and ceased to beat distally, indicating a properly executed technic, but no benefit followed. Therefore, on March 20, 1925, the second toe was amputated at its metatarso-phalangeal articulation, under a 2 per cent procaine anæsthesia. A microscopical examination of sections showed necrosis of the terminal phalanx of the second toe of the left foot, the bone, connective tissue and skin all being involved in the process.

On November 4, 1924, this man was readmitted to the hospital, with an ulcer of the stomach, for which he took the Sippy treatment. In this connection, it is interesting to speculate concerning the possible bearing of the Raynaud's disease upon the appearance of the stomach lesion. Were the same forces at work in the two, or were their presence in the same case merely coincidental? Admittedly, the spasm of the duodenal vessels with the associated tissue anæmia, could readily cause metabolic disturbances of such a character as to produce an absorption of the intestinal wall. Telford and Stopford² report a somewhat comparable case. Their patient was a man with an eleven-year history of thrombo-angitis obliterans, who was operated on successfully for a perforated duodenal ulcer. These cases may throw some light on the factors underlying the formation of gastric and duodenal ulcers. In view of the investigations made recently by Berlet³ on the distribution of the arteries to the various parts of the stomach, this seems all the more probable. This author found that the course of the vessels differs at the pyloric end from the distribution on the anterior and posterior surfaces of the stomach. In the pars pylorica very delicate arterioles run parallel to its longitudinal axis and exhibit hardly any anastomoses, while elsewhere the vessels extend almost vertically over the gastric parietes and inosculate freely.

CASE III.—The patient, a white male, age sixty-four, was admitted to the hospital, May 2, 1924, for a gangrenous second toe of the left foot. About five months before, he had begun to suffer with cold and painful feet. A little later he noticed that the second toe of the left foot had commenced to turn dark. He had had much treatment, both local and constitutional, but to no avail. Examination at the time of admission showed a gangrenous second toe of the left foot and the contiguous structures were red, œdematous, and swollen as high as the ankle. No pulsation was felt in the dorsalis pedis artery, but a weak pulse was perceptible in the popliteal. The general arterial tree was moderately sclerosed. With the exception of the above findings the man was apparently healthy. The condition was diagnosed as thrombo-angitis obliterans with

²Case also reported by Friedenwald, J. and Love, W. S., Jr. *Jour Amer Med Assn*, 1925, vol. LXV, pp. 83-85, Raynaud's Disease Complicated with Gastric Ulcer.

³Telford and Stopford. *Br Med Jour*, Lond, 1924, vol. II, p. 1035, abstr. in *Surg, Gyn and Obst*, Chicago, 1925, vol. XL, supplement, *Internat Abst of Surgery*, p. 414.

⁴Berlet. *Zeitschr f Pathol*, 1924, vol. XXX, p. 472, abstr. in *Surg, Gyn and Obst*, Chicago, 1925, vol. XL, supplement, *Internat Abst of Surgery*, p. 372.

beginning gangrene of the left foot and a peri-arterial sympathectomy suggested as offering the best chance for saving the foot

Operation—May 6, 1924, ether anæsthesia The common femoral artery was reached by a vertical incision through Scarpa's triangle and deprived of its superficial layer of areolar tissue over a length of $1\frac{1}{2}$ inches The vessel immediately contracted down to half its original size throughout the entire extent of its denudation and there was no visible or palpable pulsation below the operative site No relief followed The man complained of the pain in his foot more bitterly than ever and the gangrene continued to spread With no appreciable evidence of relief in sight, a mid-thigh amputation was done, May 14, 1924, with complete satisfaction to the patient

Peri-arterial sympathectomy has been performed four times on three patients at the University of Maryland, three for thrombo-angitis obliterans with gangrene of the toes, and once for Raynaud's disease of the foot Not once did the operation exert the slightest influence over the progress of the disease, all three patients having subsequently to undergo amputations In no instance can the failure be blamed on a faulty technic, for in each case, the artery contracted down to a mere thread throughout the entire extent of the denudated area and ceased to pulsate both to sight and to touch beyond the operative site, the occurrence of which phenomena according to Leiche is proof positive that the decortication has been properly executed

With the information in hand, nobody can forecast what the future has in store for peri-arterial sympathectomy Its acceptance or rejection is contingent upon later developments Therefore any facts with a bearing on the subject—be they favorable or detrimental—should be of genuine interest to the profession, especially as the methods hitherto used in combating these affections have been found wanting From present indications peri-arterial sympathectomy is worthless in senile gangrene, in ascending neuritis, in erythromelalgia, in causalgia and in trophic ulcers the results are more favorable, but undependable Jeanneney and Mathey-Cornat⁵ recommend it as one of the best indirect methods for securing a prompt cure of varicose ulcers, but it leaves the cause untouched, consequently recurrence is likely On the few occasions, it has been used at the University Hospital, three times for thrombo-angitis obliterans and once for Raynaud's disease, peri-arterial sympathectomy has been a complete failure The natural assumption is that these diseases are also outside of the pale of peri-arterial sympathectomy

While the series is by far too small to be staged as an infallible argument against peri-arterial sympathectomy, it should, when taken in conjunction with the research findings of Palma,⁶ be regarded as very suggestive This investigator divided the sciatic nerve of dogs to cause trophic ulcer Either prior to or coincidently with the neurectomy he performed a peri-arterial sympathectomy on the corresponding femoral artery In not a single instance did the sympathectomy hinder the appearance of the ulcer, or cause it to heal

⁵ Jeanneney and Mathey-Cornat Arch Franco-Belges de Chir, Brussels, 1924, vol xxvii, p 884, and also abst Jour Amer Med Assn, Chicago, 1925, vol LXXXIV, p 1388

⁶ Palma Ann ital di chir 1924, vol iii, p 811, also abst Surg, Gyn and Obst Chicago, 1925, vol vi, supplement, Internat Abst of Surg p 369

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Want of success, Palma attributed, to a sleeve of cicatricial connective tissue forming in the arterial tract and this, in retracting, interfered with the functioning of the artery and seemed to be of importance in diminishing the amount of blood delivered to the parts lying beyond the operative site. Furthermore, Palma found that in some cases obliterating endarteritis resulted from the injury to the vessel walls, which in association with the constriction of the arterial walls by the cicatricial sleeve, he thought, was sufficient to explain the failures and the transitory effect of peri-arterial sympathectomy.

Whether peri-arterial sympathectomy is to survive the first wave of enthusiasm accorded it, cannot be answered at the present time. Certainly before it commands anything like popular confidence, many more examples of its successful application must have come to hand. In the meanwhile, until more case-reports are available for careful study and critical analysis, a spirit of fair-play demands that all preconceived opinions—either for or against the operation—should be held in leash.

GLOSSOPHARYNGEAL NEURALGIA AND ITS SURGICAL RELIEF*

BY ALBERT O. SINGLETON, M.D.

OF GALVESTON, TEXAS

THOUGH glossopharyngeal neuralgia is not nearly so common as trifacial, it is just as definite a disease. Probably many cases pass unrecognized, because the condition is almost unknown to the medical profession. Text-books do not mention the complaint, and a search of the literature reveals only four articles written upon this subject in American literature, and a lesser number in foreign literature.

Sicard and Robineau¹ described three cases of what was termed "*Algie velopharyngee essentielle*." Two of the cases occurred in the French Army in 1916-1917, the third was presented by the author. All three had typical symptoms. Harris,² in 1921, described two cases of paroxysmal neuralgia of the glossopharyngeal which is the first record I am able to find of such cases in American literature. Doyle, in 1922, after careful study of the subject, published a very illuminating paper reporting four cases observed in the Mayo Clinic. Lillie,³ in 1922, reported three cases, though they were not typical glossopharyngeal neuralgia. In 1924, Adson⁴ published an excellent treatise on the surgical treatment of glossopharyngeal neuralgia, reporting in detail four operated cases, and stating that five additional cases had been observed since Doyle's report, making in all nine cases studied at Rochester. At this time I desire to add two cases to this list, one a patient of my colleague, Doctor Thompson, and one of my own.

Because of so little publicity, the recognition of this disease is being acquired by rather bitter experience, and at the painful expense of the patients. My knowledge of this condition was arrived at accidentally, and in an interesting manner, the relating of which will illustrate the general limited knowledge of the subject.

In 1923, my colleague Doctor Thompson, had a patient suffering with neuralgia, which was diagnosed as trifacial. An alcohol injection of the gasserian ganglion was done. The neuralgia persisted, although the trigeminal nerve was successfully anesthetized. The patient later went East where the posterior root of the gasserian ganglion was divided, without in the least affecting the pain. In discussing the case with Doctor Adson, he found that similar cases had been observed in Rochester, which subsequently had been found to show the typical syndrome of glossopharyngeal neuralgia. A review of the case history convinced Doctor Thompson that his case was evidently one of the same type. My first intimation of the existence of the disease dates from the interest the case aroused in us. With this knowledge fresh in mind I readily recognized the true nature of the case under my own care.

* Read before the Southern Surgical Association, December 17, 1925

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CASE I—(Patient of Dr J E Thompson) Unit Hist No 9511 An unmarried woman, forty-six years of age, who had been generally in good health all of her life For several years she had been having attacks of pain in the right side of her face and neck which were intermittent in attacks and paroxysmal in character The pain was chiefly present in the posterior part of the tongue on the right edge, in the tonsillar region, and in the neck deep below the angle of the jaw It was thought to be a neuralgia of the fifth nerve May 30, 1923, 2 cc of alcohol were injected into the gasserian ganglion Complete anæsthesia of the entire distribution of the fifth nerve resulted, but the neuralgic pains continued The patient left Galveston and later went to a very capable neurological surgeon in the East, who did a posterior root gasserian resection about December, 1924 A communication from the patient's brother, who is a physician,

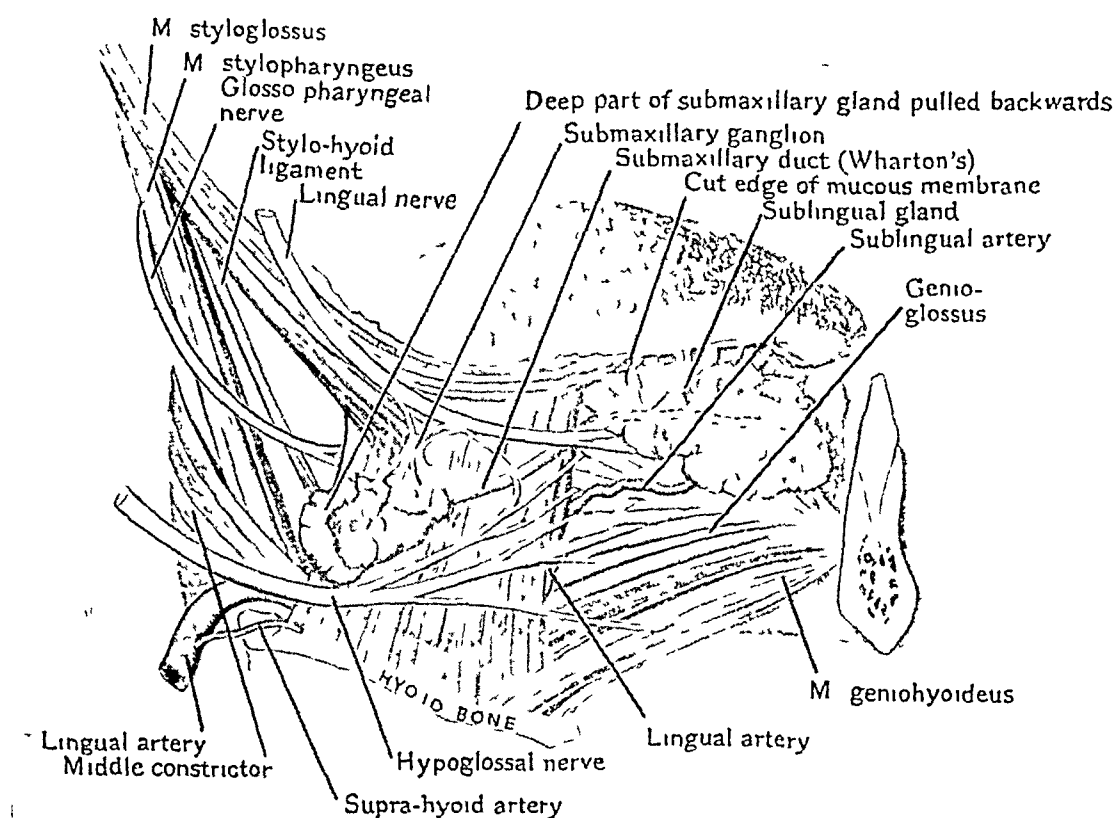


FIG 1 —From Cunningham showing relation of glossopharyngeal nerve to stylopharyngeus muscle

was received several months ago He stated that the pain had not been relieved by the operation, and that the surgeon had made a post-operative diagnosis of glossopharyngeal neuralgia

CASE II—Unit Hist No 15,610 Mrs C T, forty-five years of age, married and the mother of several children She has been in good health all of her life About two years before she began to have trouble on swallowing, which at times caused pain in her throat on the left side After a while the pain in her neck was accompanied by pain radiating to the left ear The attacks would leave for a little while but soon reappear, and now they have grown more and more severe She has been to many doctors without relief All of her teeth have been extracted in an effort to relieve the pain For the past three or four months she has had her ear treated by an otologist, without relief of pain in the ear She came to Galveston and consulted an otologist who being unable to find ear or throat trouble referred her to me with a tentative diagnosis of trifacial neuralgia

Physical examination revealed a stout woman in fairly good condition with heart and lungs normal, blood-pressure 135 over 90, and urine normal All her teeth had been pulled, and her throat and tonsils were apparently normal It was impossible to

make a satisfactory examination because of her intense suffering. She sat with her face in her hands, one finger of her left hand pressed over her left ear, and the fingers of her right hand pressed against the left side of her neck. Any effort at talking, or swallowing precipitated a painful spasm. She had been unable to take food or even water for two days. After being sent to the hospital and a hypodermic of morphine given, the pain became less severe and she was able to take liquid with difficulty. Pressure over the exits of the fifth nerve on the face would not start the pain, but swallowing and often talking precipitated a spasm. With the history of the first case in mind a diagnosis of glossopharyngeal neuralgia was readily made. In an effort to relieve the patient and not being familiar with any known procedure for relief, I evulsed the glossopharyngeal nerve, June, 1925. Relief was immediately complete. The patient complained of a full

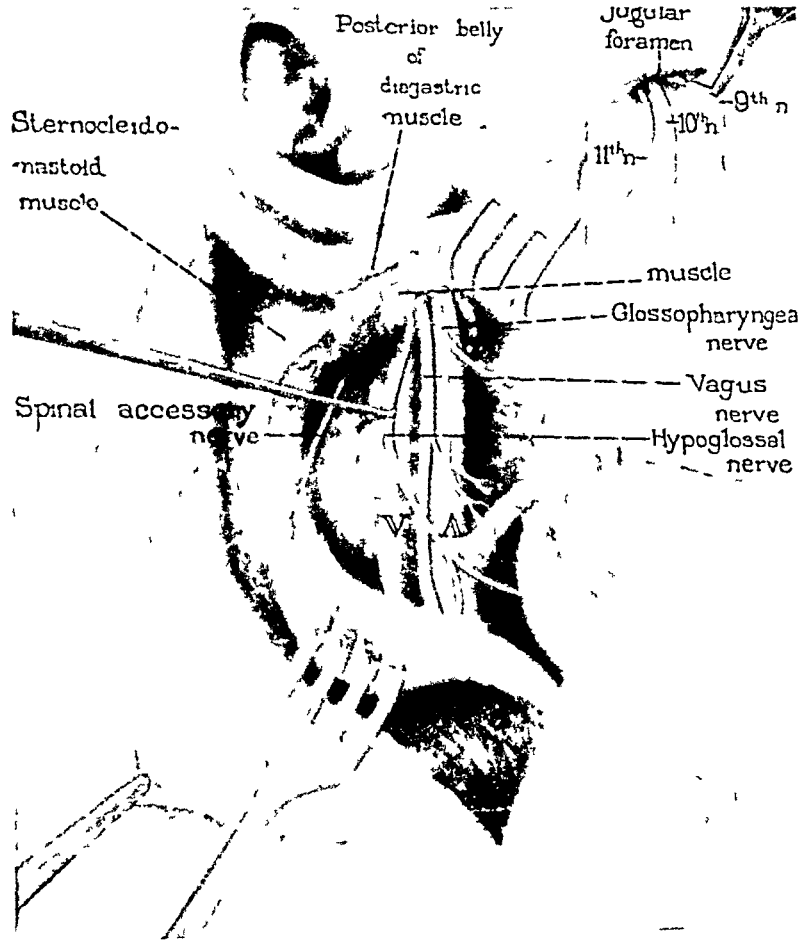


FIG. 2.—From Adson showing relations of nerves just outside the jugular foramen and Adson's methods of avulsing glossopharyngeal nerve.

feeling in the neck and throat on the left side, but swallowing and talking were without pain. Also the pain in the ear was relieved. Relief has continued up to the present time.

The anatomy and function of the glossopharyngeal nerve has been discussed exhaustively by Adson and Doyle and their monographs should be carefully read by those interested in this subject. The glossopharyngeal nerve is a mixed nerve with both motor and sensory

fibres, including the special sense of taste. The sensory fibres reach the mucous membrane of the middle ear, tongue, tonsillar fossæ and oral pharynx. The nerve originates in the medulla oblongata and anterior column of the cord with its superficial origin from the rostral end of the posterolateral sulcus of the medulla oblongata in a line with the tenth and eleventh nerves. It has two ganglions—the petrous and dorsal root ganglion. Leaving the skull through the jugular foramen, it passes between the internal carotid artery and the internal jugular vein, and passes behind the styloid process. At the lower border of the stylopharyngeus it turns around and runs forward superficial to

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it It breaks up into terminal branches which ascend to palatine tonsil, posterior third of dorsum of the tongue, soft palate and glosso-epiglottic folds, and anterior aspect of the epiglottis Before reaching the side of the tongue it supplies the stylopharyngeus and sends branches to the pharynx⁶

The branches of the glossopharyngeal nerve are (1) tympanic, (2) pharyngeal, (3) muscular, (4) tonsillar, (5) lingual The glossopharyngeal nerve with its branches is intimately connected with the sympathetic system, as well as contributing to the geniculate and otic ganglion through the tympanic branch It has two larger ganglions, the petrous and dorsal root ganglion, at the lower and upper part of the jugular foramen Since the tympanic branch, as well as other connecting branches, arise from these ganglia, it is natural to suppose that it requires the section of the nerve above these ganglions if the neuralgia is to be cured If glossopharyngeal neuralgia is similar or analogous to trifacial neuralgia, this would seem to be true On this assumption, Adson has formulated an operation for exposing and resecting the glossopharyngeal nerve through an intracranial approach

Symptoms—Glossopharyngeal neuralgia and trifacial neuralgia are strikingly similar as to the character of pain, and the duration and interval between attacks But in the former the distribution of the pain is in the tonsillar region, throat and ear, with a trigger zone in the tonsillar fossa In fact, the similarity is so striking that most cases have been treated for trifacial neuralgia Doctor Adson reports having divided the posterior sensory root of the gasserian ganglion in his first case The patient not being relieved led him to further investigation, resulting in our present knowledge of the disease Also one of the cases I am reporting had had alcoholic injections in the gasserian ganglion and subsequently a resection of the posterior sensory root of the gasserian ganglion The attacks of pain are paroxysmal, chiefly in the region of the tonsil and pharynx, and radiating to the ear on the same side Swallowing brings on the pain and it may be brought on by stimulating the pharynx, but not by rubbing the face over the termination of the branches of the fifth nerve The suffering is intense The patients are afraid to drink or eat, and become quite desperate in their suffering

Treatment—The injection of alcohol for glossopharyngeal neuralgia is not to be considered because of the close proximity of the vagus nerve, and large blood-vessels Therefore, surgical procedures must be resorted to Theoretically, and probably actually, as with trifacial neuralgia, intracranial resection is necessary for permanent relief in most cases The operation planned and described by Adson⁷ appears quite feasible, though as yet has not been made use of The operation for the extra-cranial evulsion of the nerve as carried out by Adson seems to give relief over a long period of time, but according to the author it is a delicate procedure, complicated and difficult, necessitating gentle retraction of nerves He describes the procedure as follows "The incision was made parallel to the anterior border of the sternocleidomastoid muscle, extending upward for a distance of 2.5 cm above the tip of the mastoid for a distance of 10 cm On exposing the sterno-

cleidomastoid, it was found to be advantageous to divide half of its attachment on the mastoid and retract it outward, in order to obtain sufficient exposure, the dissection was then carried inward and upward behind the angle of the mandible along the skull, dividing the posterior belly of the digastric and stylohyoid muscles, gently retracting the parotid upward and outward. On retraction of the parotid, the spinal accessory was the first nerve exposed, this passes obliquely downward and outward from the jugular foramen underneath the posterior belly of the digastric. In order to obtain greater exposure, the external carotid was divided after the occipital artery had been given off and the hypoglossal nerve, which lies superficial and lateral to the jugular

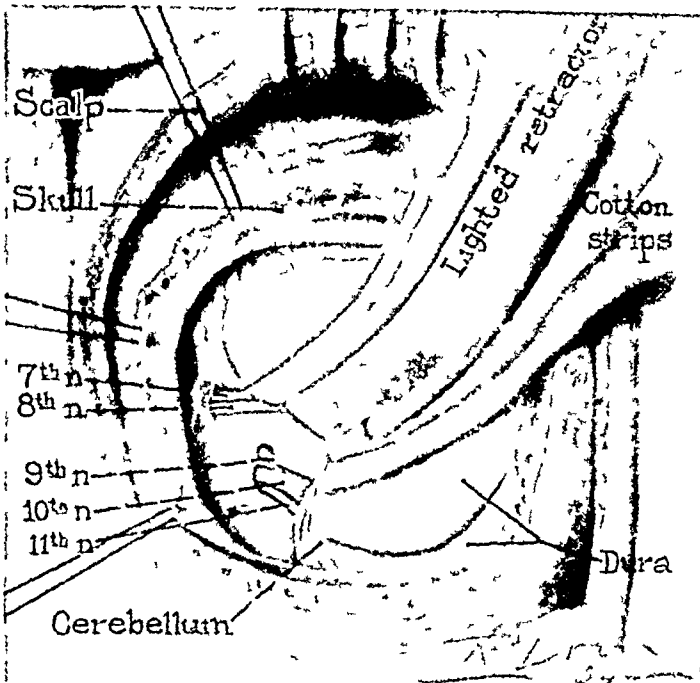


FIG. 3.—Exposure of the seventh, eighth, ninth, tenth and eleventh cranial nerves at the point of exit from the skull preliminary to the division of the glossopharyngeal nerve. (From Adson.)

vein, was exposed. On dissecting free the jugular vein, the vagus nerve was brought into view, with a mesial pharyngeal branch which might be mistaken for the glossopharyngeal nerve. By carrying the dissection back to the jugular foramen, it can be identified as a part of the vagus nerve, carrying the dissection mesially, the internal carotid, and then the upper portion of the cervical sympathetic ganglion are encountered. After the vagus, the internal carotid, and the sympathetic nerves have been identified, the glossopharyngeal nerve will be found emerging from the jugular foramen, anterior to the tenth nerve, crossing anterior to the internal carotid, dipping beneath the styloid process, following a downward course along the posterior belly of the stylopharyngeus muscle before it disappears beneath the hyoglossus muscle."

The operation as done on my patient has not been done long enough to be a test of a cure, but it can at least be recommended for its simplicity and comparative ease of performance. Upon the cadaver, one should familiarize oneself with the relations of the nerve in order to more readily recognize it.

An incision was made along the anterior border of the sterno-mastoid muscle from the ear downward for three inches. The sterno-mastoid retracted outward and the linguo-facial vein ligated and cut, and the posterior belly of the digastric isolated. The parotid gland was pulled forward. The stylohyoid muscle with the posterior belly of digastric were retracted downward

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and backward. The external carotid artery was seen behind and above these muscles, and it was pushed backward. The stylopharyngeus muscle was seen deep beneath the angle of the jaw and above the retracted stylohyoid muscle. Along the lower and anterior border of the stylopharyngeus the glossopharyngeal nerve was seen like a white thread. It was grasped and evulsed. The wound closed without damage.

Intracranial division of the glossopharyngeal nerve as described by Adson.⁸ "The incision is that used in performing unilateral cerebellar decompression, it is carried from the spine of the atlas upward to the external occipital protuberance, then, in the form of a horseshoe, it is carried up to the lateral sinus and down over the mastoid to its tip, the skin and muscles are reflected in the same manner as they are reflected for cerebellar decompression, and the bone is removed upward and laterally, exposing the lateral and the sigmoid sinuses. The

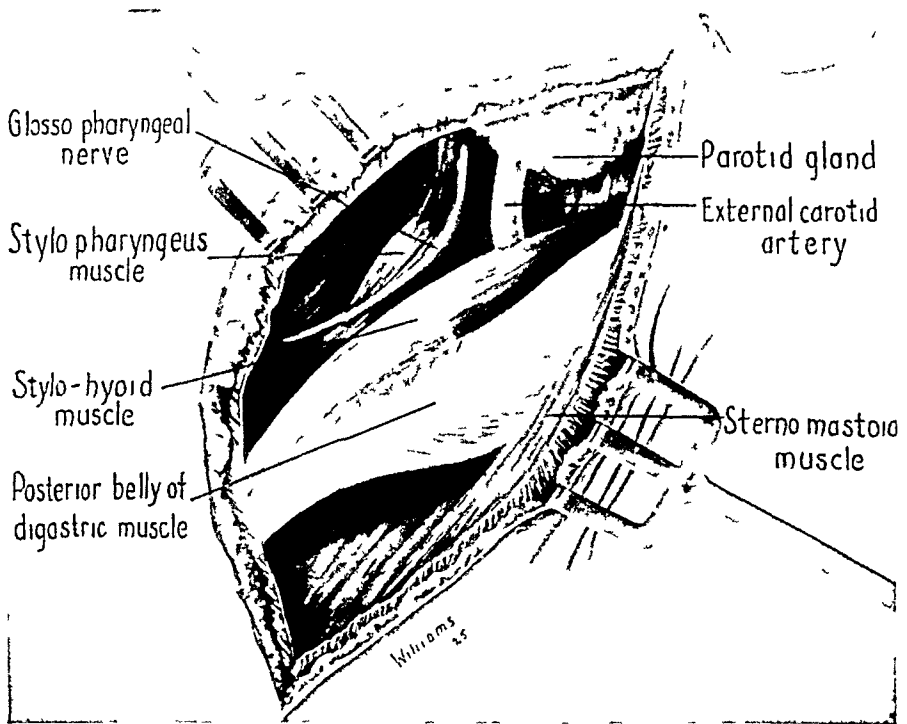


FIG 4—Showing relations of glossopharyngeal nerve and stylopharyngeus muscle to stylohyoid muscle and external carotid artery—a simple approach for peripheral avulsion.

bone is removed mesially and downward until the external occipital crest, the posterior condyloid foramen and the margin of the foramen magnum are approached, the dura is then incised and reflected mesially with a basal flap along the crest of the occipital bone. If the cerebellar lobe does not displace easily, one can either drain the posterior cistern or the posterior horn of the lateral ventricle through a separate incision above the lateral sinus. Before elevating or displacing the cerebellar lobe, it is well to cover the cortex with strips of cotton, then with the illuminated retractor elevate the lateral lobe of the cerebellum, when the seventh and eighth cranial nerves can readily be seen entering the internal auditory meatus. Inferior to these nerves and slightly more superficial, one will observe the ninth, tenth and eleventh nerves entering the jugular foramen, on closer observation, the ninth and tenth nerves are found to be short and to pass at almost right angles from the medulla, while the spinal accessory is longer

and enters the foramen in an oblique course. Further, it will be seen that the glossopharyngeal enters the foramen at the upper portion, and is separated from the vagus by a small dural band which is less than 1 mm in width, but definite enough to permit one to pass a small right angle ganglion knife between the fibres of the vagus and glossopharyngeal nerves, thus facilitating a sharp section of the glossopharyngeal nerve."

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QUESTIONS INVOLVED IN OPERATIVE PROCEDURES IN CASES OF GASTRIC AND DUODENAL ULCERS*

BY AUGUST SCHACHNER, M D

OF LOUISVILLE, KY

No OTHER problem in medicine is in a more unsettled state or attended with more conflicting opinions and results than the treatment of gastro-duodenal ulcers. The methods and results of recognized clinics in one part of this country are in direct contradiction to the methods and results of recognized clinics in another part of this country, each of these having equally efficient surgical technicians, with equally trustworthy, scientific surgical writers.

An air of conservatism prevails on this side of the Atlantic, and largely in England, that has been entirely discarded in some of the ablest clinics here and on the Continent. While such a conflicting status prevails and continues, it is obvious that the question of gastroduodenal surgery must remain submerged in doubt and indecision. It is impossible for both the conservative and the radical group to be in the right. There must be an error somewhere and one of the two groups must, if not entirely, at least in the main, be in the wrong.

One sees a large clinic claiming to cure, at least, ninety-five per cent of duodenal ulcers by a gastro-enterostomy, and, when necessary, combined with excision, with a mortality of one to two per cent, and gastric ulcers if combined with cautery or knife excision ninety per cent with a mortality of two to three per cent, the result being well nigh one hundred per cent cures.

Compare this with other clinics with equally able operators who have abandoned gastro-enterostomy as a routine operation because, as they frankly state, they are unable to obtain anything near such results—it is time that we “slack up a bit” and do a little hard thinking.

One would hardly expect a normal human being to select the more difficult method of resection in preference to the easier method of gastro-enterostomy if the same, or about the same, results could be obtained by the easier method. Many still remain to be convinced that ninety or ninety-five per cent of gastric and duodenal ulcers can be cured in a manner that they will remain cured and not in a short time thereafter revert to the internist or undergo other operations in the hands of other surgeons. In view of this, would it be unreasonable for one to suspect that gastro-enterostomy has achieved its immense popularity because of the comparative ease of its performance? Broadly speaking, in the past and mainly in the present it has been and is still largely hailed as a “cure all” for all surgical conditions of the gastro-duodenal region. This popularity we believe is beginning to recede to within

* Read before the Davies County (Ky.) Medical Society, November 17, 1925

its normal limits Should its popularity be based upon its ease of performance its foundation is an unsound one Should it become necessary for the more difficult operation of resection to supplant the easier gastro-enterostomy, it would behoove us to develop our technical ability until we are able to do resections with as low or about as low a mortality as a gastro-enterostomy Such has been the procedure of some of the best gastro-intestinal surgeons upon the continent, and is beginning to be adopted by an increasing number of American surgeons

The alluring claims for gastro-enterostomy are not only suspected by many, but are openly disputed by able gastro-enterologists The results of a well-known eastern clinic where gastro-enterostomy as a routine has been supplanted by resection is "A perfect cure in nearly fifty per cent, (47) of our cases, to this may be added a small group (19), with fair results" This same clinic was also influenced in abandoning gastro-enterostomy because of the disastrous gastrojejunal ulcers that attend gastro-enterostomy and that are absent in properly performed resections This complication is usually more formidable than the original complaint for which the gastro-enterostomy was performed In one series of cases reexamined in this clinic after a duration of four to nine years, thirty-four per cent suffered from gastrojejunal ulcers of which, eighteen per cent were reoperated upon and in sixteen per cent the diagnosis was based upon clinical symptoms and X-ray findings

There is also a conflict of opinions as to the underlying method through which the result claimed is obtained, namely, Moynihan, Deaver, and others, claim that gastro-enterostomy is purely a drainage operation and functionates upon a mechanical basis as drainage According to Cannon, peristaltic pressure and fluidity is greatest at the pylorus whether there is a stoma or not, and especially, when the stomach is distended does the food prefer the pylorus to the stoma Paterson disregards the drainage element entirely and claims the result through a reduction of the gastric acidity—a purely chemical basis

Although ulcers may exist in the presence of a low gastric acidity, or absent in a high gastric acidity, it is generally conceded that the gastric acidity is the key to the problem A properly reduced acidity means a cured patient It is upon the question of acidity that the controversy mainly or entirely hinges Those who favor the more radical procedure of resection have been charged with doing too great and an unjustified amount of surgery for the size of the lesion involved This charge is hardly a fair one since the gastric resection is not based upon the size of the lesion but upon the underlying chemical condition that is supposed to be responsible for the lesion

The acid cells are in the cardiac end and the hormone that regulates the activity of these cells is in the pyloric end Their conclusion is that through the removal of the hormone, through resection the activity of the acid cells is regulated in proportion to the extent of the gastric resection There is a reduction of the acidity upon which the cure is based and upon which the absence of the undesirable gastrojejunal ulcers rest To this there are some

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are exceptions as there are to all rules, but with the reduction of one-half of the pyloric end or more there is a dependable reduction of the acidity as claimed by the protagonists of this method and a completeness and permanence of the cure

It is not the province of this paper to under-rate the value of a gastro-enterostomy if confined to its proper limitations. As a drainage procedure to pyloric obstruction it is invaluable. But, its indiscriminate application is to a great degree bringing it into disrepute. Quoting from Bastedo's paper

"Of 261 ulcer cases returning for treatment after operation Smithies found that gastro-enterostomy had been done in all. Of six thousand, four hundred and two operations of all types for benign ulcer of the gastroduodenal area done at the Mayo Clinic, Eusterman reports that 4793 were posterior gastro-enterostomies."

"In 1921, Babcock said, 'Gastro-enterostomy is perhaps a makeshift which is better for duodenal than gastric ulcer,' and at the 1922 meeting of the American Surgical Association, Crile's opinion was that 'to do a gastro-enterostomy is just as much a confession of failure as to amputate a limb,' that is, it is a failure to restore the part physiologically. In similar tenor, Bland-Sutton (1916) placed it in "the class of operations of despair."

Much has been said of gastro-enterostomy as a drainage operation whereas it is only a drainage operation provided the pylorus is closed or the stoma is unusually large, otherwise, the gastric contents are "swished" past the stoma, especially when the stomach is distended, in accordance with the well-recognized law of onward peristalsis. The peristaltic rest and the relief from irritation to the antrum and pylorus through peristalsis and pressure of which so much in favor of gastro-enterostomy has been said, after all, usually fails to take place. Lastly, an acid juice which in part or entirely was believed to be responsible for the duodenal ulcer is poured into the jejunum which is less able to receive it than the duodenum, and hence we have marginal and peptic ulcers of the jejunum with their attending fistulae that were unknown before the era of gastro-enterostomy, and that represent a more formidable condition than the original one, for which the operation was performed.

The mortality of the exponents of resection as a substitute for gastro-enterostomy are fairly represented by those of Moynihan, Haberer, Finsterer and perhaps others, to two to three per cent, not more than from gastro-enterostomy.

It is proper, however, to emphasize the fact that such a mortality only prevails in the hands of expert operators. In the hands of those not specially trained the mortality is doubtless a high one. This, however, does not justify us in performing an improper operation that happens to harmonize with our limited ability rather than it befits the demands of the pathology involved. It is not unlike the past history in neurologic surgery where the operative mortality of gasserectomy, which is the only permanent cure for a true neuralgia was a prohibitive one until operators specialized thereon overcame the difficulty and thus reducing this prohibitive mortality to a reasonable figure. It would seem that our aim should be to acquire through experimental

observation and study an increased efficiency that would enable the operator to carry out the proper procedure with a proper mortality

As gastric ulcers remaining or developing after a gastro-enterostomy may undergo cancerous degeneration, the resection offers a more reliable safeguard against such a danger than a mere gastro-enterostomy

Lewisohn says "It is, indeed, very interesting that support in favor of resection comes from the internist. Many physicians who had occasion to compare the permanent cures following resection of the stomach with the many failures following simple gastro-enterostomy are strong supporters of the resection

"It is generally assumed that the incidents of gastrojejunal ulcers following gastro-enterostomy is about five per cent. However, if we analyze statistics dealing with the late results following gastro-enterostomy we find that this figure is not based on definite data. Many authors are not able to say positively what happened to their patients after an interval of some years. They consider only the few patients who come back to their Clinic for re-operation"

Aside from gastro-enterostomy and resection we have the Finney and the Holsley operation, as eligible procedures for duodenal ulcers. The underlying principles of each are about the same, namely, relieving the pyloric end of muscular activity and irritation through a better outlet for the gastric contents. Thus setting at rest and relieving the peristaltic pressure. In these the anatomy and physiology of the stomach does not undergo the same degree of change as in either of the other operations. Where the ulcers are adherent or the mobility interfered with, these procedures which otherwise possess distinct advantages may become more difficult or undesirable by reason of such limited mobility.

In conclusion there should be emphasized the unsettled state of many questions bearing upon gastroduodenal ulcers, such as their origin, many of their clinical phases and, lastly, their proper classification with reference to treatment, medical or surgical, and if surgical, the type of operation best suited to the case involved.

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THE HEALING OF THE GASTRIC ULCER IN MAN*

BY HAROLD D CAYLOR, M D

OF ROCHESTER, MINN

FROM THE SECTION ON SURGICAL PATHOLOGY OF THE MAYO CLINIC

AN ADEQUATE description of intermediate stages in the healing of gastric ulcer in man is not available, although certain phases in the developmental history of such ulcers have been known for a long time. The first stage is probably the acute hemorrhage in the mucosa and submucosa which grossly may be only a red spot with a slight break of the glistening membrane. Microscopically there is a defect in the epithelium with free blood in the excavation and adjacent tissues. This early ulcer is usually cone-shaped, the apex of the cone being towards the muscularis, and the base at the lumen of the stomach. The second well-known picture is the chronic U-shaped gastric ulcer. The gross appearance of this lesion is common knowledge. The walls of the ulcer

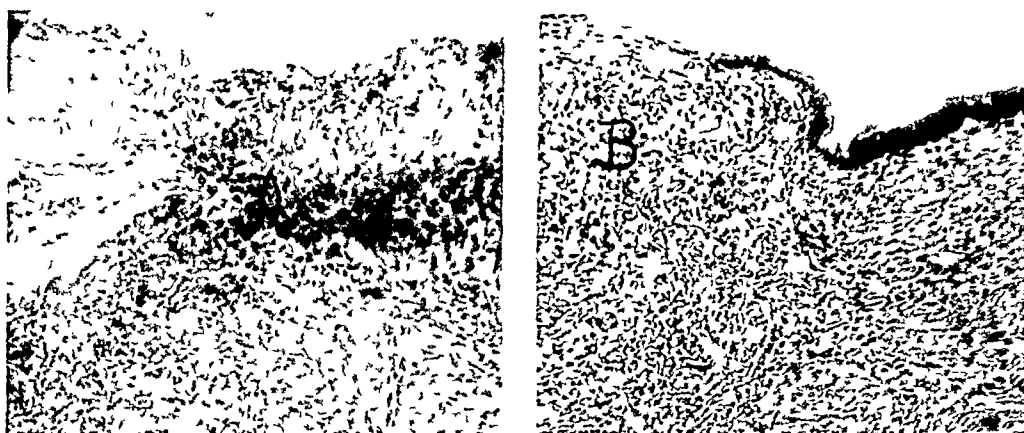


FIG 1—Peptic ulcer produced experimentally, illustrating the organizing blood clot in the ulcer cleft (a) and the mushroom shaped granulation tissue (b) developed in the base of the defect with cuboid epithelium growing from the margin to cover the plug. This ulcer was protected from the gastric contents for five days. (Published through the courtesy of Dr F C Mann and the Saunders Company from *Surgical Clinics of North America* 1925 v p 766) (x 100)

are composed of fibrous connective tissue infiltrated with lymphocytes, plasma cells, leucocytes and mast cells. There is connective tissue in the base of the defect and occasionally an organizing fibrinous exudate, granulation tissue, and necrotic material.² Blood-vessels in the deeper tissues of the wall opposite the defect may be thrombosed or contain canalized thrombi. At the edges of the ulcer the epithelial cells flatten and attempt to cover the denuded area.^{2, 3, 6, 9, 10} In the final stage after the gastric ulcer is healed, there is a pale pink to gray scar covered by mucous membrane. The epithelium topping the scar is a thin layer of cuboidal to columnar cells. Just beneath this layer are deformed cystic glands,⁷ and surrounding these fibrous, connective tissue infiltrated with inflammatory cells.⁶ The muscularis is replaced by fibrous tissue.

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The whole life cycle of experimentally produced peptic ulcer in animals has been thoroughly studied by Mann and his co-workers^{11, 12, 13} from the first break of the mucosa with hemorrhage and destruction of the epithelium to the covering of the scar-filled defect. One of Mann's original contributions to our knowledge of the healing of peptic ulcers was his observation that following protection of the lesion from the gastric contents the hemorrhage in the ulcer became organized and a granulation-tissue "mushroom," containing inflammatory cells and very rich in blood-vessels, grew from the base of the lesion into the



FIG. 2 —Duodenal ulcer with organizing fibrinous exudate in the base ($\times 27$)

organizing blood clot in the cavity of the ulcer. On this framework the epithelial cells grew out as a single flat layer from the edges of the crater up

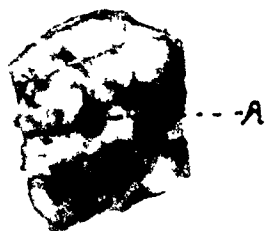


FIG. 3 —Gross appearance of the gastric ulcer with granulation tissue in the base at (A)

the stalk of the mushroom and over the top until the granulation tissue was covered by mucosa (Fig. 1). Finally atypical crypts developed on the surface and cystic glands in the deeper layers of the mucosa. In experimentally produced ulcers of the most chronic perforating type, healing processes were constantly taking place. Epithelial cells were continually attempting to grow from the edges of the ulcer across the base. Granulation tissue was persistently attempting to form in the cavity of the ulcer.

Mann has observed a single layer of epithelium trying to bridge a perforated peptic ulcer that was closed only by omentum¹⁴. Epithelial cells apparently creep out in this insecure position only to be swept off and destroyed. Experimentally produced ulcers did not heal unless granulation tissue grew from the base of the ulcer as a bed for the oncoming mucosa¹¹. There was an incessant battle between the forces of repair and destruction.



FIG. 4 —Flattened epithelium covering the plug of granulation tissue in the edges of the ulcer ($\times 50$)

Kennedy has recently described a duodenal ulcer found in a child dying of melena neonatorum which had all essential features of healing noted in experimentally produced peptic ulcers,

In the following case a gastric ulcer removed at operation was studied This lesion exhibited the reparative changes described by Mann in his experimentally produced ulcers



FIG 5—Diagrammatic sketches illustrating the stages in the healing of gastric ulcer Sketch (a) healed edge of the ulcer Sketch (b) break of the mucosa at the base of the ulcer (a) with an organizing blood clot in the defect (b)

Exertion caused dyspnoea and palpitation The patient was a poorly nourished young man 5 feet 9 inches tall, weighing 129 pounds Oral examination revealed periapical infection of the teeth 3, and infection of the tonsils 2 There were tenderness and increased resistance in the epigastrium Two hundred seventy cubic centimetres of a test-meal was recovered one hour after administration Analysis of this meal revealed a free acidity of 20 and a total acidity of 44 Hæmoglobin was 78 per cent, the erythrocytes numbered 4,450,000, and the leucocytes 7800 Examination of the urine was negative The Rontgen-ray diagnosis was ulcer at the pylorus, with retention 2 The patient was transferred to the hospital and given a "retention diet," which consisted of milk, custards, cereals and eggs in small feedings every two hours On two successive days the stomach was lavaged and no retention noted At operation one ulcer was found in the stomach and one in the duodenum The duodenum was opened and the duodenal ulcer excised, then the incision was carried up into the stomach and the gastric ulcer removed The closure was made as a gastroduodenostomy The

A man, aged thirty-two, had complained of indigestion for four years He had had typhoid fever in 1916 A gonorrhœal infection was admitted Otherwise his health had always been good He drank coffee once a day and smoked a pipe moderately The present illness began as an intermittent epigastric distress coming on from two to three hours after meals The pain was described as a "sore ache" It did not radiate and was not relieved by soda, but was eased by taking more food He was frequently distressed with gas When the epigastric discomfort came on the patient was nauseated Vomiting always relieved the distress All raw fruits or acid drinks that were taken were vomited immediately In the last month he had lost weight (12 pounds), strength, and appetite

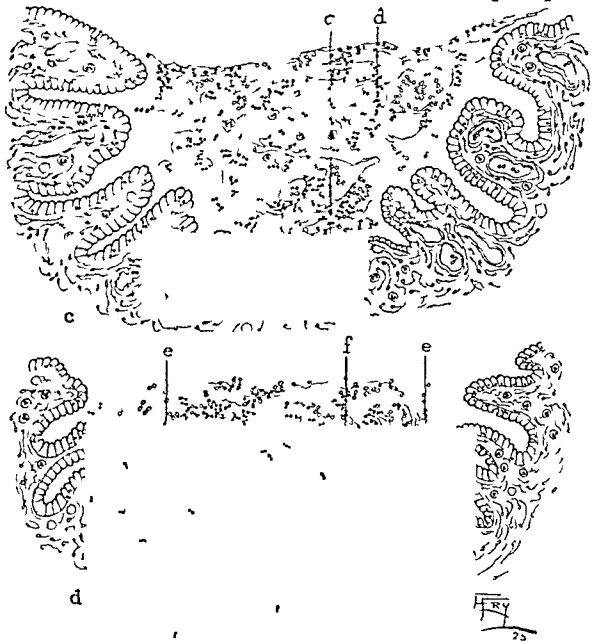


FIG 5—Sketch (c) Flattened epithelium growing in from the edge of the ulcer (c) with formation of a mushroom of granulation tissue in the defect of the mucosa (d) Sketch (d), cuboidal epithelium attempting to cover the plateau of granulation tissue in the ulcer (e) Recent hemorrhage (f) with a break of the epithelium covering the base of the ulcer

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appendix was also removed. The gastric ulcer was 3 mm in diameter and the duodenal ulcer 6 by 3 by 1 mm. The pathologic report regarding the appendix was chronic catarrhal appendicitis. Fifteen days after operation the patient was dismissed from the hospital in good condition.

There was an organizing fibrinous exudate in the base of the duodenal ulcer. At the edges of the cavity the epithelial cells were flattened and apparently attempting to grow down and cover the excavation (Fig 2). The gastric ulcer revealed unusual changes, in the base of the cavity and almost filling it was a raised gray to pink area (Fig 3). This ulcer was put into 10 per cent formalin immediately after being photographed, and serial sections were cut later.



FIG. 6.—Ulcer with blood clot in the defect. The fibrosis of the base of the ulcer and the break of the mucosa are revealed. (X 22)

Preparations from the margin of the excavation contained a raised "plateau" or "mushroom" of granulation tissue covered by a single layer of flattened gastric epithelium (Figs 4 and 5a). Nearer the centre of the ulcer there was a definite break in the mucosa with an organizing hemorrhage in the ulcer cavity (Figs 5b, 6, and 7). Continuing toward the centre of the ulcer more advanced organization of the blood clot was revealed with development of blood-vessels in the clot and tissue adjacent in the base of the ulcer. A definite plateau had developed in the ulcer as described by Mann. In some areas the epithelium at the margin of the defect had lost its columnar character, become cuboidal and apparently grown out on this granulation-tissue bed and up the sides of the mushroom (Figs 5c and d, 8, and 9). There were many concentric organizing hemorrhages in some regions of the ulcer. At one place in the ulcer cavity there was free blood with an abrupt fault of the epithelium and tearing loose of granulation tissue (Figs 5d and 10). Gram stains of sections of tissue from the ulcer made

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FIG. 7.—Break in the mucosa (a) with organizing hemorrhage in the defect. (X 60)

granulation-tissue bed and up the sides of the mushroom (Figs 5c and d, 8, and 9). There were many concentric organizing hemorrhages in some regions of the ulcer. At one place in the ulcer cavity there was free blood with an abrupt fault of the epithelium and tearing loose of granulation tissue (Figs 5d and 10). Gram stains of sections of tissue from the ulcer made

according to Rosenow's technic revealed many Gram-positive diplococci in the deeper granulations of the ulcer. Distant from the ulcer no organisms were

found except on the surface of the mucosa. Rosenow¹⁶ and others^{1, 5, 8, 15} have observed morphologically similar organisms in peptic ulcers of man (Fig 11).

Discussion —

This unprotected peptic ulcer illustrates the constant struggle between the healing and ulcerative forces. Notwithstanding

FIG 8 — Flattened epithelium at (a) growing from edges of the ulcer on the granulation tissue in the base of the defect ($\times 120$)

the probable constant activity of traumatic agents (mechanical, chemical, bacterial) granulation tissue formed in the base of the ulcer and epithelium grew out on this scaffold. Our observations coincide with those of Cohn, that peptic ulcers are constantly attempting to heal. Slight trauma to the epithelium growing out to bridge the fault frequently causes hemorrhage and arrested healing, as was illustrated in certain areas of this ulcer (Fig 10). Partial dislodging of the granulation-tissue plug in an ulcer causes bleeding. This probably occurs frequently. It may explain the paradox occasionally encountered of a patient with symptoms of a bleeding peptic ulcer in whom at operation a few weeks later no ulcer can be visualized, the ulcer probably having healed in the interim of beginning symptoms and operation.



FIG 9 — Epithelium along edges of mushroom of granulation tissue at (a) ($\times 80$)

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The granulation tissue bud in the base of the ulcer was a very important factor in healing. Mann¹⁴ has always found this peculiar formation in every



FIG. 10.—Fresh hemorrhage at (a) with a sharp break in flattened epithelium and loosening of granulation tissue ($\times 100$)

experimental peptic ulcer that was healed or partially healed. Kennedy described such a plug in his case and the case reported here exhibited this structure. It is possible that chronic gastric ulcers continue unhealed, enlarge concentrically, and become perforated be-

cause they cannot produce this element. The dense fibrosis of the walls and base of chronic peptic ulcers with the accompanying reduced blood supply may be a factor in inhibiting the formation of granulation tissue. This influence of poor blood supply on healing is well illustrated in Röntgen-ray burns with their marked vascular changes. Small ulcers with overhanging borders which protect the granulations in the base apparently heal much more readily than large callus peptic ulcers. If granulation tissue does form in the centre of a large ulcer its position is so precarious that it may be soon dislodged. The healed ulcer with its thin layer of epithelium and irregular glands is a place of low resistance and easily breaks down and ulcerates again¹⁵.

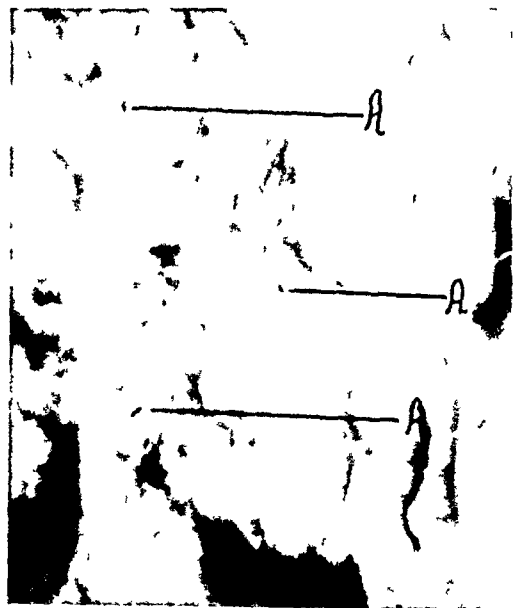


FIG. 11.—Gram-positive diplococci in the granulation tissue in the base of the ulcer at (a) ($\times 400$)

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CARCINOMA OF THE RIGHT SEGMENT OF THE COLON^{*}

BY CHARLES H. MAYO, M.D.

AND

WILLIAM A. HENDRICKS, M.D.

OF ROCHESTER, MINN.

WHILE there are several chronic diseases more destructive to life than cancer, none is more feared. The fact that death from cancer is on the increase is not only an added problem of medicine, but it at the same time testifies to the wonderful efficiency of medical science in the prevention and cure of most of the destructive diseases and in increasing the average age of man. This postponing of death enables more persons to live long enough to develop some kind of cancer in old and less resistant tissues.

On account of the great interest manifested by the public in cancer (and, in fact, in everything pertaining to the subject of disease and health) diagnosis is made earlier and operations are consequently more successful

on external cancers than can be observed or felt by the physician or the patient himself. This shows the advantage of the public discussions on cancer, cancer-week talks, and the effectiveness of newspapers in aiding in this work of education.

It is stated that there are more than 3000 cures for cancer now on record and new ones (or old ones revived) are being constantly advocated.



FIG. 1.—Carcinoma of the cecum.

^{*} Presented before the Southern Surgical Association, December 15, 1925.

What is most desired is first a diagnostic blood test for the disease and then a curative treatment which, to be worthy of consideration, must be equally effective for both internal and external cancer

That a remedy will be developed with more knowledge of cancer is believed by most who have some appreciation of the history of medicine. In pathology the greatest advance was that made by Virchow in the cellular theory. The abnormal changes in the function, growth and arrangement of cells constituting a cancer have been well described by many. The clinical

experience in cancer at the clinic has been greatly aided by the observations of the pathologists, that is, in the studies on cancer, the changes in the cells, and the development of defensive tissue with its effect on a cancer cell. All have been viewed with reference to the progress of the patient over a period of years, with or without operative or other treatment. This is the basis for the real constructive knowledge which can stand the destructive criticism of pathologists trained in the study of embalmed tissues and not in pathology of unchanged frozen tissue. The work of MacCarty and Brodeur on the morphology and differentiation of malignant cells and the relation of these to classification, diagnosis, and



FIG. 2.—Anatomic relation of cæcum, ascending colon and hepatic flexure.

prognosis has done more to clarify the cancer question and establish rational treatment than any contribution since Virchow's classic lectures on cellular pathology. With tissue from the tumor a pathologist thus trained, when furnished with the data secured by the surgeon at operation for the removal of a section, or radical, or palliative operation, will make a most accurate prognosis on the probability of cure or the length of life of the individual with any particular form of cancer.

The surgical treatment of cancer is now much more effective than it was twenty years ago, the operations are much more thorough, and fixed and locally advanced growths involving the primary and secondary lymphatics, and those with contact growths or metastasis are treated by radiation or other

CARCINOMA OF RIGHT SEGMENT OF COLON

non-surgical measures, and thus reduce the unnecessary surgical mortality. Moreover, such cancers as commonly metastasize in bone or in the lungs are not operated on without careful physical and roentgenographic examination, and surgery is thus spared the blame for many of the early deaths and so-called recurrences that used to be all too common after operations of greater than ordinary risk.

In considering special areas affected by malignant neoplasm, the surgeon must constantly study the operative risks and primary and late results, and investigate those methods which are attended by the least risk or most satisfactory results. There are often several factors which may influence the surgeon, but the essential ones are low mortality, increased comfort and satisfactory late results. In the alimentary tract cancer has a predilection for areas where the tissue cells normally change or in areas subject to traumatic or irritative cellular change, in natural or unnatural flexion angles and areas of spastic contraction with or without diverticula of the colon.

The Röntgen-ray is now indispensable in the accurate diagnosis and location of neoplasm of the alimentary tract. In a large percentage of cases carcinoma of the large bowel is seen late, this

is probably more true of the right segment of the colon with its liquid contents, than of the left and lower segments of the colon in which the faeces are more solid. Blood-stained mucus or stool is less commonly noticed than in cases of tumor of the left or lower segments in which fecal traumatism is more likely. Pain is seldom a factor of importance before the onset of partial obstruction, tumor may be felt, but gases and general distention of the abdomen, or natural fat may obscure even a large tumor until late. The same kind of cellular change causing adenocarcinoma or squamous-cell carcinoma (the cause of which is yet unknown) may produce two carcinomatous areas at the same time at widely separated areas in the large bowel. In a recent case of resection

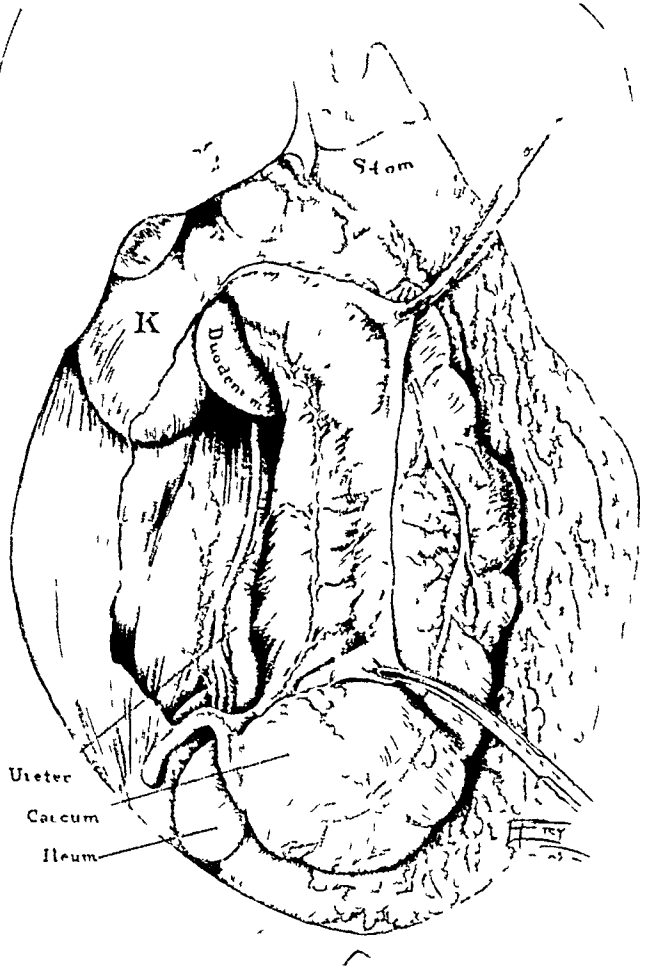


FIG 3—Incision through right leaf of the mesentery for reflection of right segment of the colon. Relations to duodenum, right kidney and ureter are shown.

of the sigmoid for carcinoma followed by death, it was shown at necropsy that of three mucous polyps in the cæcum, all too small to feel through the bowel, one was carcinomatous and similar to the growth in the sigmoid. The obstruction occurs earlier when the area of the ileocæcal valve is involved in the disease, such growths greatly shorten the bowel locally. They are situated in the cæcum, the cæcum and ascending colon, in the ascending colon, or alone in the hepatic flexure (Fig 1). In the last case they may also encroach on the transverse colon. We believe in removal of the right segment of the colon

with a few inches of the ileum for carcinoma at any point from the ileocæcal coil to the hepatic flexure (Fig 2). While the areas involved are specified in the individual record they are classified together for operative treatment. Since the return blood from this area drains through the portal veins into the liver it would seem that that organ would be early affected by metastasis, but filtration is so perfect around this sewer that carcinoma cells are not passed into the portal veins, and the liver is involved later than in cases of carcinoma of the left and lower segments, where, apparently at an earlier period, the traumatism of the carcinoma by hard feces plays a greater part in its dissemination, in lymphatic metastasis, and the formation

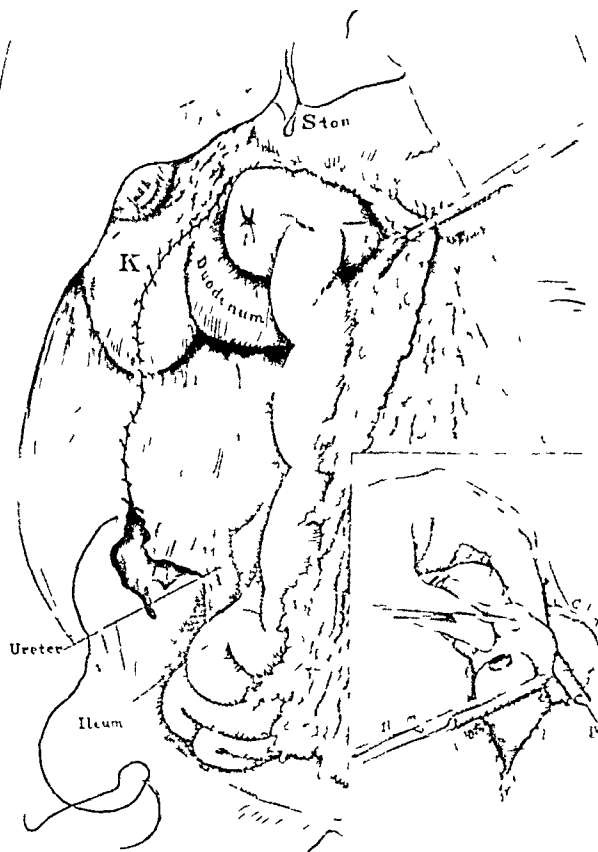


FIG 4—Resection and anastomosis complete (Murphy button type), parietal peritoneum closed

of adhesions. Carcinoma of the small bowel early involves the lymph-nodes on account of the lacteal and lymphatic absorption.

Nature placed but few lymph-nodes along the colonic sewage system, and even these may be enlarged by inflammatory change in the presence of an ulcerated carcinoma. Therefore it must not be taken for granted that the enlarged nodes are cancerous, especially those of the mesentery of the ileocæcal coil which are more often inflammatory. Since the cæcum and ascending colon originate embryologically on the left side of the abdomen and pass upward across to the right and down to the iliac fossa, it is clear that all of the tissues of importance, the nerves and vessels, are necessarily on the inner half of the colonic mesentery, the outer one merely being for support

CARCINOMA OF RIGHT SEGMENT OF COLON

and fixation In operations on the right segment of the colon the division of the peritoneum should be made on the white line of attachment of the outer mesenteric leaf to the parietal peritoneum This immediately permits the colon to swing out of the abdomen and the operative work is greatly simplified (Fig 3)

If the bowel in the area of the tumor is movable a radical operation is advisable The ileocaecal coil and right segment of the colon are best removed and the ileum united to the transverse colon (Fig 4) As this is a neces-

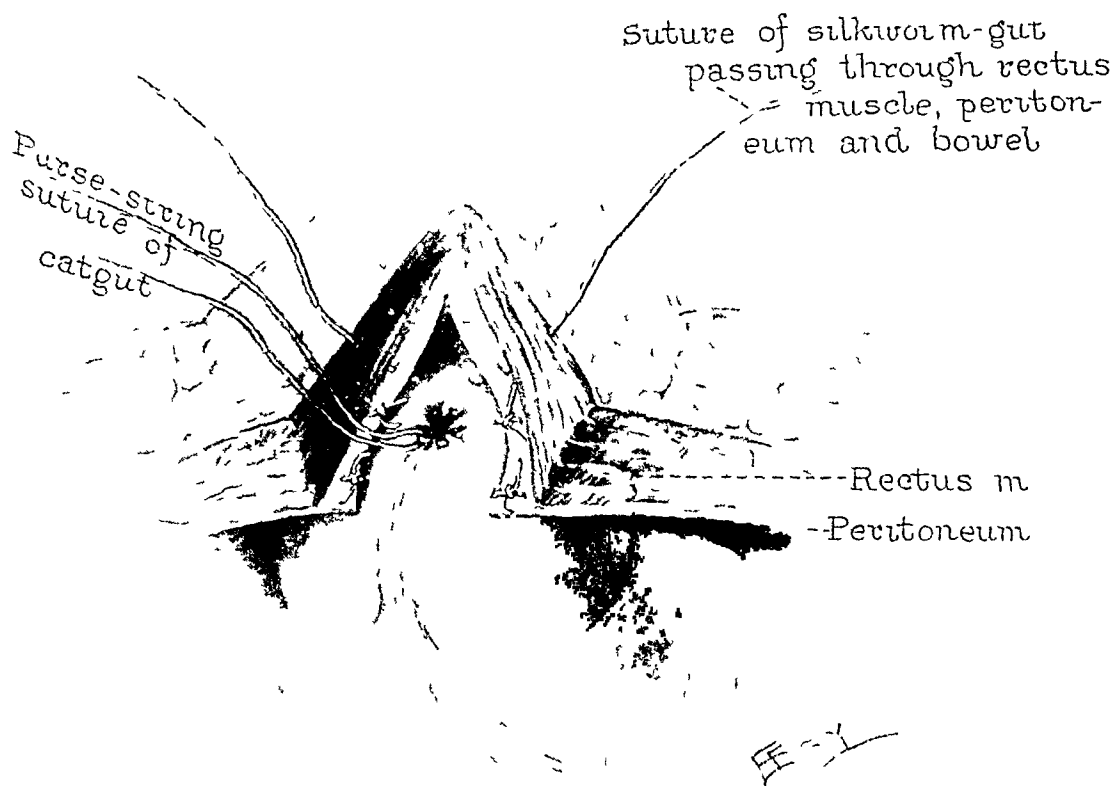


FIG 5 —Fixation of stump of colon to parietal peritoneum at site of incision, the purse-string suture being left hanging

sary part of the operation, the ileocolostomy may be made as the first portion of a two-stage operation when the operative risk is high At a later period resection is carried out, and both small and large bowels divided and closed to the right of the anastomosis In such cases small enemas and a rectal tube usually relieve the danger of gas tension on the suture line at the anastomosis In most cases the operation is completed at one period In such cases of the end-to-end, or side-to-side, or end-to-side methods of anastomosis, We prefer an end-to-side union of ileum to transverse colon Here is an ideal situation for the Murphy button The ileum is divided first and the small half of the button placed in its end, on division of the colon, the larger end is inserted loose in its lumen, and the end of the bowel closed, the button manipulated to press its anastomosing tube against the side of bowel through which an opening is then made into the tube The tubular part is pushed

through the bowel wall and united with its other half in the ileum. Some surgeons relieve gas tension by inserting a catheter into the bowel (Witzel method). If this is done at the time of operation or later as required, and the catheter passed through the omentum and a stab puncture of the abdomen, the final withdrawal of the drain causes no fistula. As paresis and gas tension are manifested in approximately only one case in five, it is best to incor-

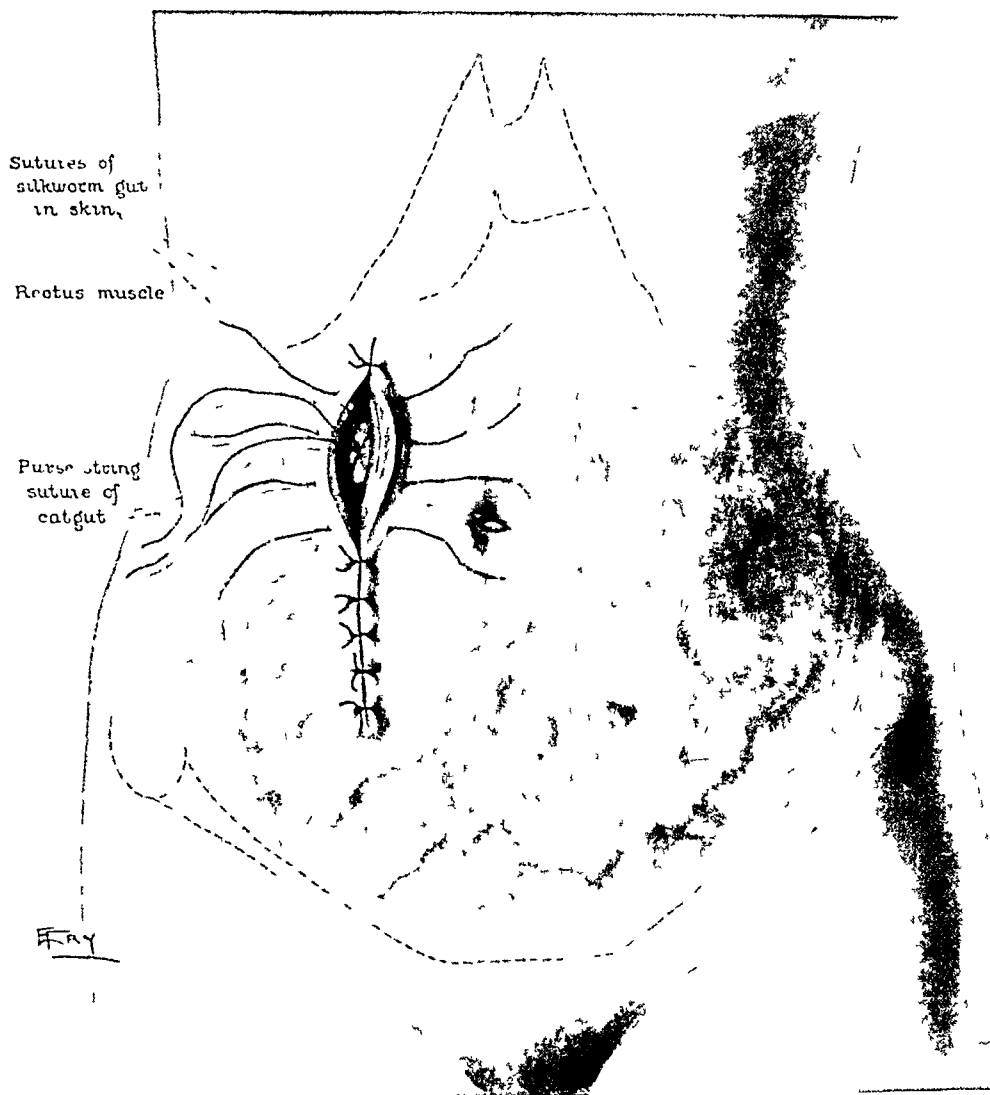


FIG. 6—Closure partially complete with stump of colon in depth of wound and suture strands from the stump hanging externally

porate the closed end of the colon (which extends 65 cm beyond the site of anastomosis with the ileum) in the peritoneal closure of the abdominal wall, without allowing it to project into the muscle. The sutures which closed the end of the colon are left long and hang out as muscle and skin are closed (Figs 5 and 6). A bit of gauze is inserted to overlap the end of the bowel. Should gas tension occur within four days, the gauze is removed, the threads drawn tight, the bowel punctured and a catheter inserted. Such an opening does not require a closure, but if there has been no trouble from

CARCINOMA OF RIGHT SEGMENT OF COLON

paries and gas, the gauze is removed on the fifth day, the threads of catgut cut short and an alcohol-pad dressing applied. This procedure is actually a life-saving device in case of need. Puncture can be carried out at any time. No anæsthetic is required, and only but a moment's work during the operation to plan for its application, if it is demanded. If not required within the first four days it will not be needed.

A fixed tumor by deep attachment on the mesenteric side often involves the duodenum or even the ureter (Fig 3). There may be secondary attachment to the parietal peritoneum and often metastasis. In such cases extensive radical operations are usually ill-advised and unless an ileocolostomy is indicated to relieve obstruction, had best be cut short after exploration.

From January 1, 1915, to October 1, 1925, at the Mayo Clinic, 257 patients with carcinoma of the right segment of the colon were advised to undergo operation. Of these 141 are known to be dead, a few, however, did not die from carcinoma. There were thirty-four patients not traced in spite of every effort.

It was possible to resect the bowel in 143 cases, the Mikulicz operation being performed in eight for tumor of the hepatic flexure. In fifty-seven of the total cases the extent of the disease or the presence of metastasis made resection inadvisable, yet in thirty-three of these the obstruction necessitated ileocolostomy. The danger of any operation in the several conditions is about the same from the standpoint of the general or local condition and complications. There were forty deaths within the first month, and fifteen others within six months. A better showing is that eighty-nine patients lived from six months to two or more years, and that fifty-five of seventy-five patients have lived from one to four or more years. Better still, twenty-five patients have lived from six to eight or more years, and twelve of them are alive from eight to nine years after operation. It is not expected that ileocolostomy for carcinomatous obstruction without resection will greatly prolong life, or the question will arise why resection was not performed. At the best, the results of operations for carcinoma are not good, yet all patients die if the carcinoma is not removed. Many months of life may be made possible by a palliative operation, but resection for cases of advanced and fixed carcinoma may not lengthen life as much as a palliative operation. The decision is often most difficult.

COLONIC POLYPOSIS WITH ENGRAFTED MALIGNANCY¹

A TECHNIC FOR REMOVING THE ENTIRE COLON INCLUDING THE RECTUM

By ROBERT C COFFEY, M D

OF PORTLAND, ORE

THERE is probably no benign process in which there is a higher incidence of malignancy than colonic polyposis Erdmann and Morris in the April,

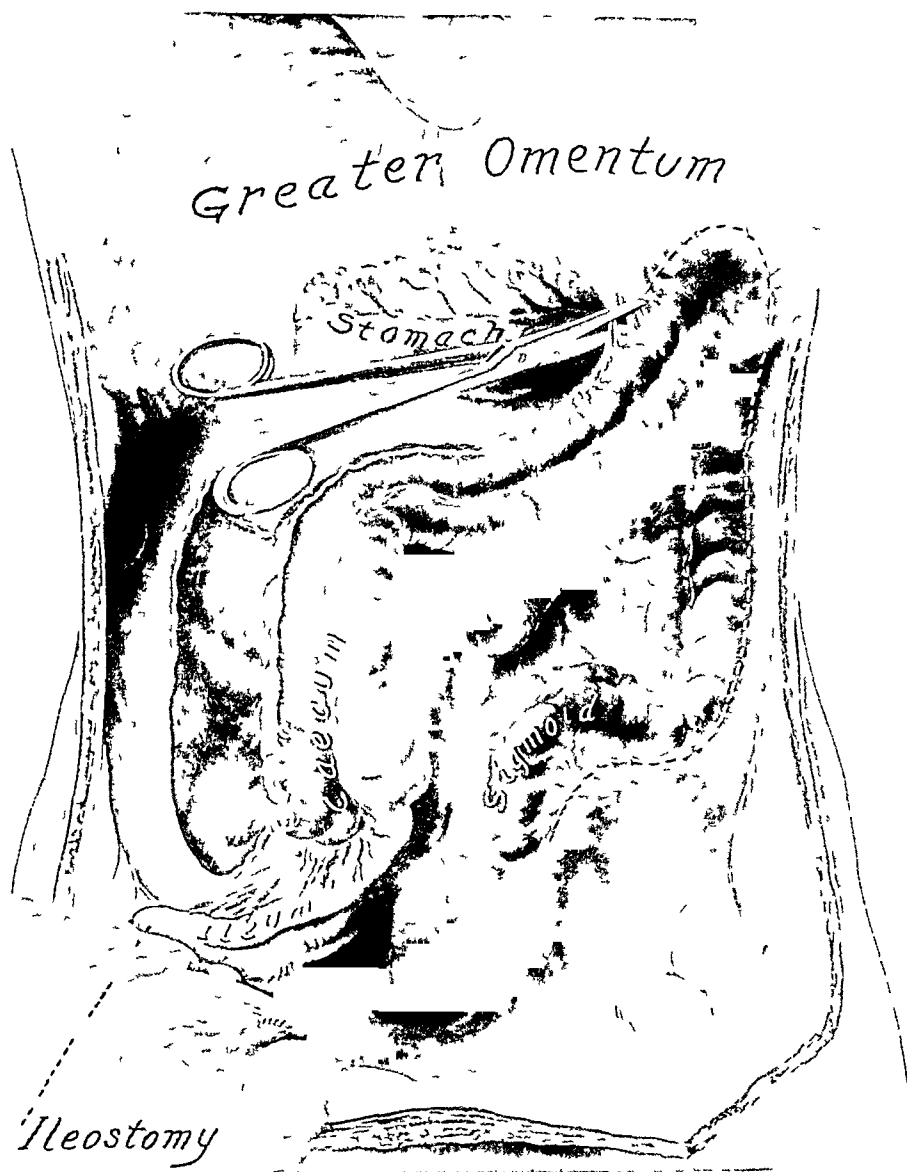


FIG 2—Colon being mobilized by cutting peritoneum outside of ascending and descending colon and cutting under surface of omentum from transverse colon

1925, number of *Surgery, Gynæcology and Obstetrics*, have concisely covered the clinical picture of this disease The closing paragraph of this article

* Read at the meeting of the Southern Surgical Association at Louisville, Ky, December 16, 1925

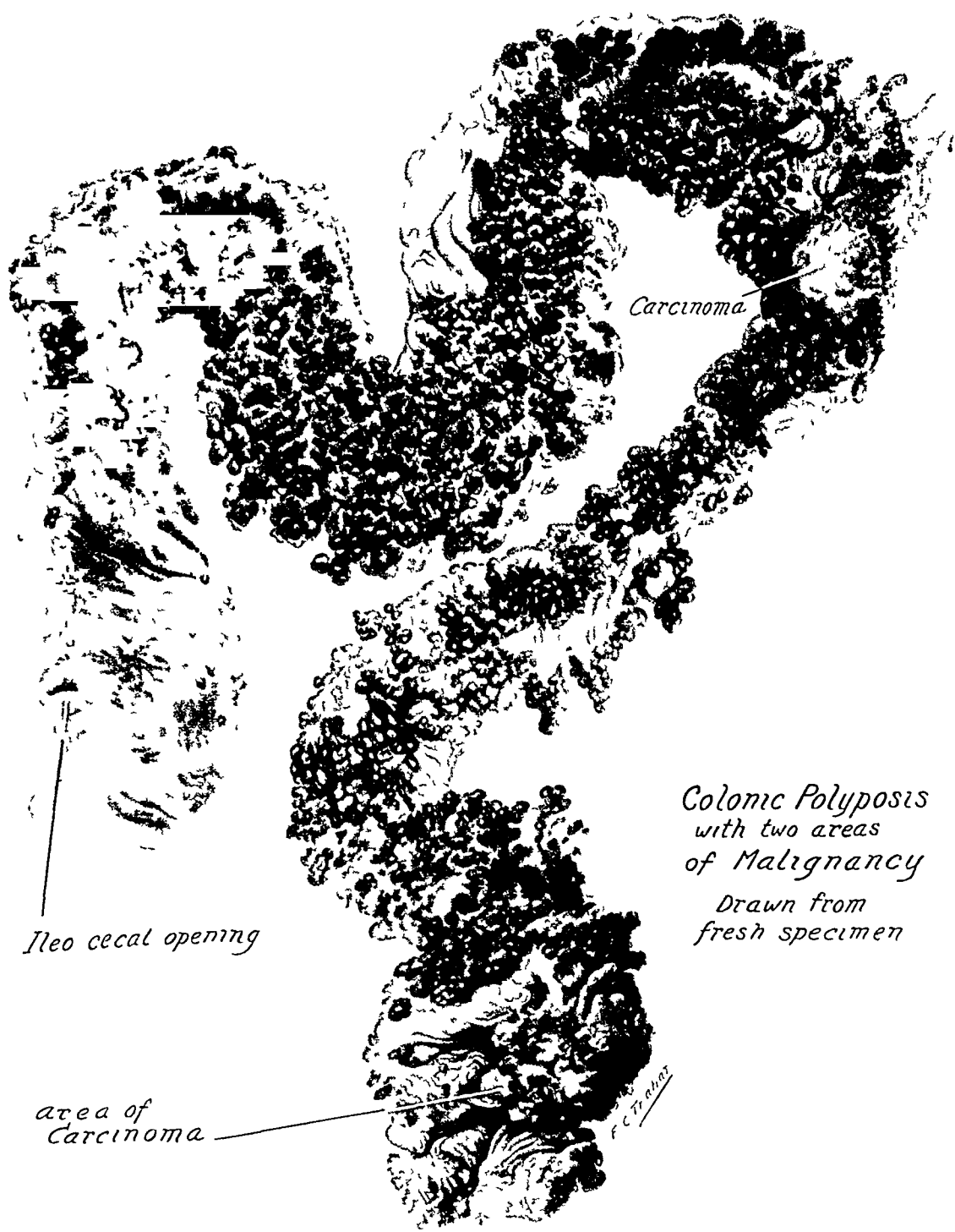


FIG 1 —Colonic polyposis with two areas of malignancy Drawn from fresh specimen

COLONIC POLYPOSIS WITH ENGRAFTED MALIGNANCY

dealing with the treatment of this condition, offers but slight hope in the way of cure. It follows:

"Indications for treatment are the depleting hemorrhage and diarrhoea and the high malignancy incidence. Non-radical, palliative treatment comprises cæcostomy, appendicostomy, irrigations, and radium therapy. Radical, effective treatment, excision of the polyp bearing area, is limited by technical difficulties and the inability to predict, pre-operatively, the extent of the process."

It is in this connection that I hope to offer a slight contribution by relating a case which has a typical history of the acquired type of polyposis referred to by Eidmann and Morris. The process in this case involved the entire large intestine from the ileo-cæcal valve to the anus. The entire mucosa was studded with literally hundreds of polypi. One large polyp located in the rectum was removed two years and four months prior to the final operation and at that time was classified by one pathologist as adenoma and by another as adenocarcinoma. Two years and four months of complete unilateral exclusion by ileostomy failed to reduce the mass

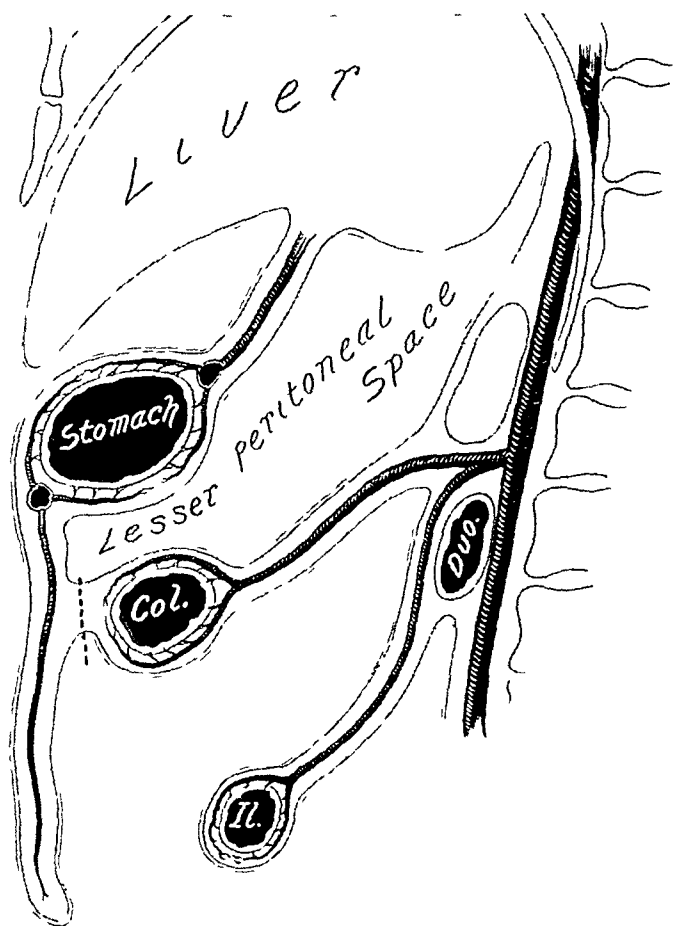


FIG 3—Normal fusion of omentum and transverse colon. Dotted line shows point where incision can be made without severing large vessels.

of polypi. During this interval, two widely separated areas of definite malignancy developed. Cure was finally brought about by complete removal of the colon, including the rectum. The patient has lived a very comfortable life and is reported well one year and six months after operation.

It must be conceded that every disease should be treated on the basis of its pathology. It is quite generally conceded that colonic polyposis results from an antecedent inflammatory or ulcerative condition of the mucous membrane of the colon.

Hewitt and Howard, also Struthers and other authors, explain the development of polypi on the basis that polyposis results from colitis, dysentery and from resultant undermining ulcers in some such manner as the

following Where blood supply is good (near primary arterioles) mucosa is preserved Hyperplasia and regeneration of glands and submucous connective tissue takes place with amelioration of the ulcerative process Margins are smooth and rounded off, causing rounded sessile projections The mucosa regenerates about and over these elevated parts, even over surrounding sub-

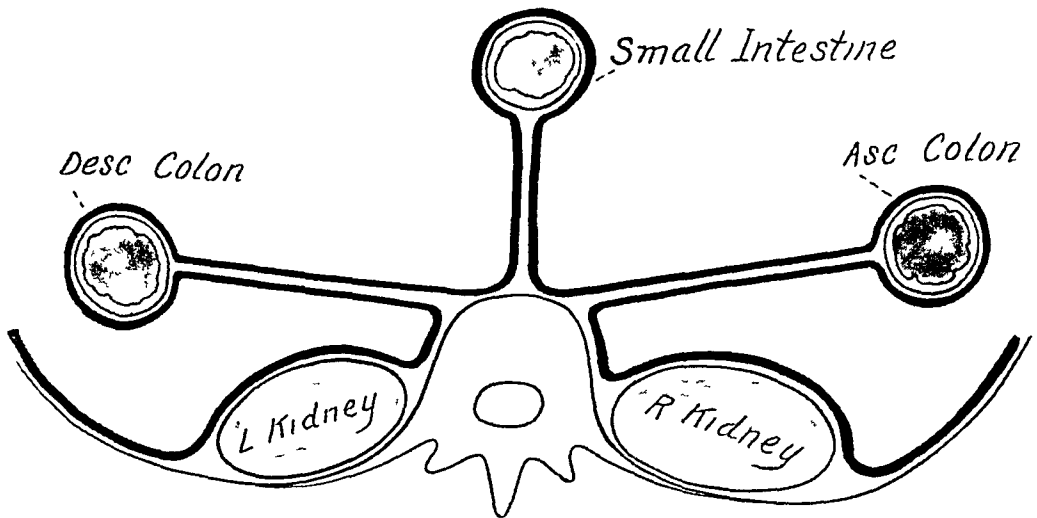


FIG 4—Scheme showing peritoneal arrangement in transection of infracolic compartment of abdomen before fixation of ascending and descending colon (Redrawn from Huntington)

mucosa and muscle layer Coincident with healing, fibroblasts contract, leading to the occlusion of the orifices of the tubules situated in the elevations Retention cysts are formed if there are secreting cells in the walls Since there are more gland cells over the surface of the polyp than over the

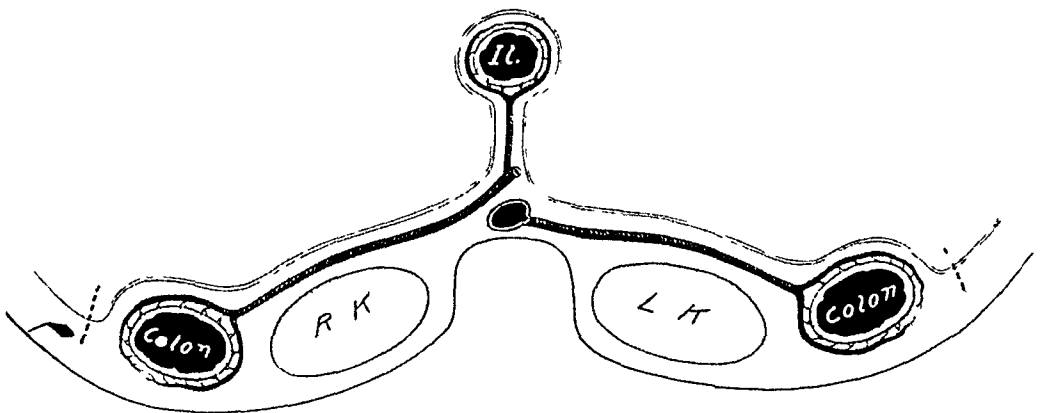


FIG 5—Normal attachment of ascending and descending colon Dotted line indicates line of peritoneal incision for mobilization of the colon

surrounding mucosa, the polyp may be a collection of small cysts Pedicle formation is due to looseness of the submucosa and the drag on it by peristaltic pull on the tumor If the blood-supply theory be true, the polypi should be found at the side of the colon and rectum where the principal blood-supply comes in Hewitt and Howard claim this to be true Struthers says

COLONIC POLYPOSIS WITH ENGRAFTED MALIGNANCY

it is not, although he also favors the ulceration theory of the polyp formation. In my case, the polyps covered the entire circumference of the intestinal mucosa. Ewing has very much the same conception of the development of this disease but lays particular stress on a chronological transition by successive steps from a diffuse thickening to hyperplasia, to lymphocytic infiltration, to the formation of new stroma cells, blood and lymph-vessels, to one of frank sessile or pedunculated tumor formation and finally to the development of adenocarcinoma. Erdmann says he has repeatedly been able to demonstrate in the same gross specimen all morphological gradations from simple

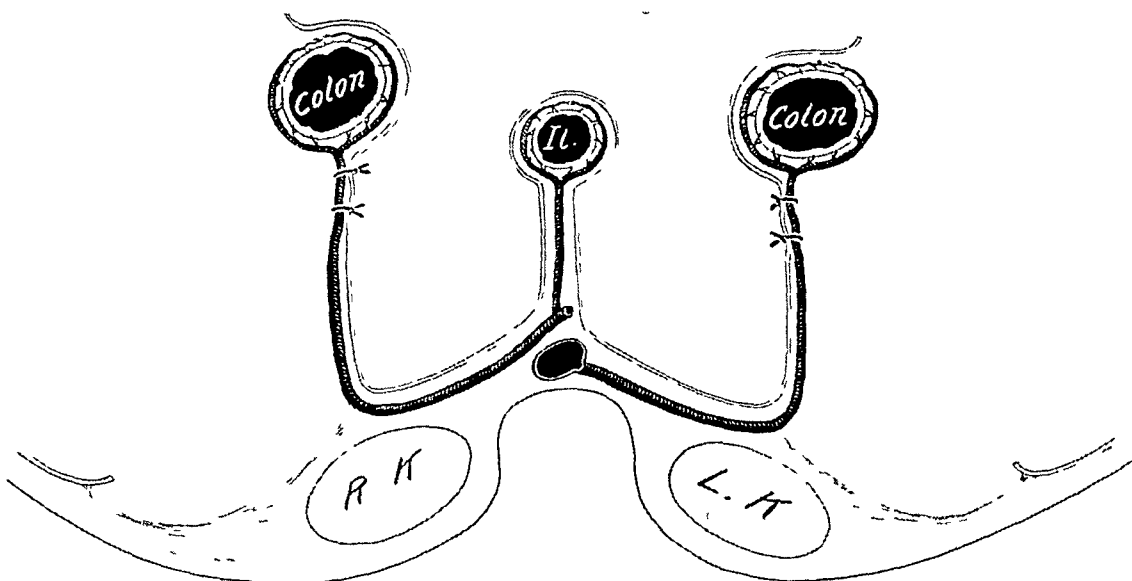


FIG. 6—Ascending and descending colon mobilized. Diagrammatic view of ligatures.

polyps through early infiltrative tendencies on up to frank and unquestioned adenocarcinoma. He claims as Ewing's opinion that nowhere can the logical transition from simple inflammatory hyperplasia to tumors which are morphologically, pathologically and clinically adenomata and carcinomata, be more clearly demonstrated than in these cases of colonic polyposis.

Soper says that 43 per cent of these colonic adenomas are malignant. Thorbecke believes that 50 per cent of such polyps finally undergo malignant degeneration. Others believe that practically all such cases carry the potentialities of malignancy if the case lasts long enough. My case herein reported is quite typical of the more severe type of colonic polyposis.

July 18, 1922, a woman was admitted to our Clinic. She was aged thirty-nine, married thirteen years, one child. Nine years ago noticed a "running off of the bowels," lasting ten days—some blood. A recurrence took place twice during the next year and other recurrences with increased symptoms have been recorded since that time. Five years ago the patient had severe hemorrhage from the bowels lasting four or five days. The stools during this time were described as clotted blood. She was taken to the hospital where some relief was obtained. A year later she had influenza and what she called gastritis, followed by another hemorrhage lasting four or five days. Bowels were moving about once every hour, mostly blood. Nothing could be taken by mouth for three days. She now states that her stomach has been very weak for past six months. She says the intestine protrudes through the rectum for past year by which

she evidently means protrusion of the large polyp from the rectum. She has had cramps in calves of the legs and has had rheumatism in the shoulders. Has palpitation of the heart, dizzy spells, headaches, sometimes feels smothered. Physical examination in general revealed nothing. Proctoscopic examination as follows: Penetration 25 cm. Bowel wall studded with fungoid soft masses of tissue. These masses are irregular (wart-like) in outline and vary in size from that of a pea to a mass in the rectum.

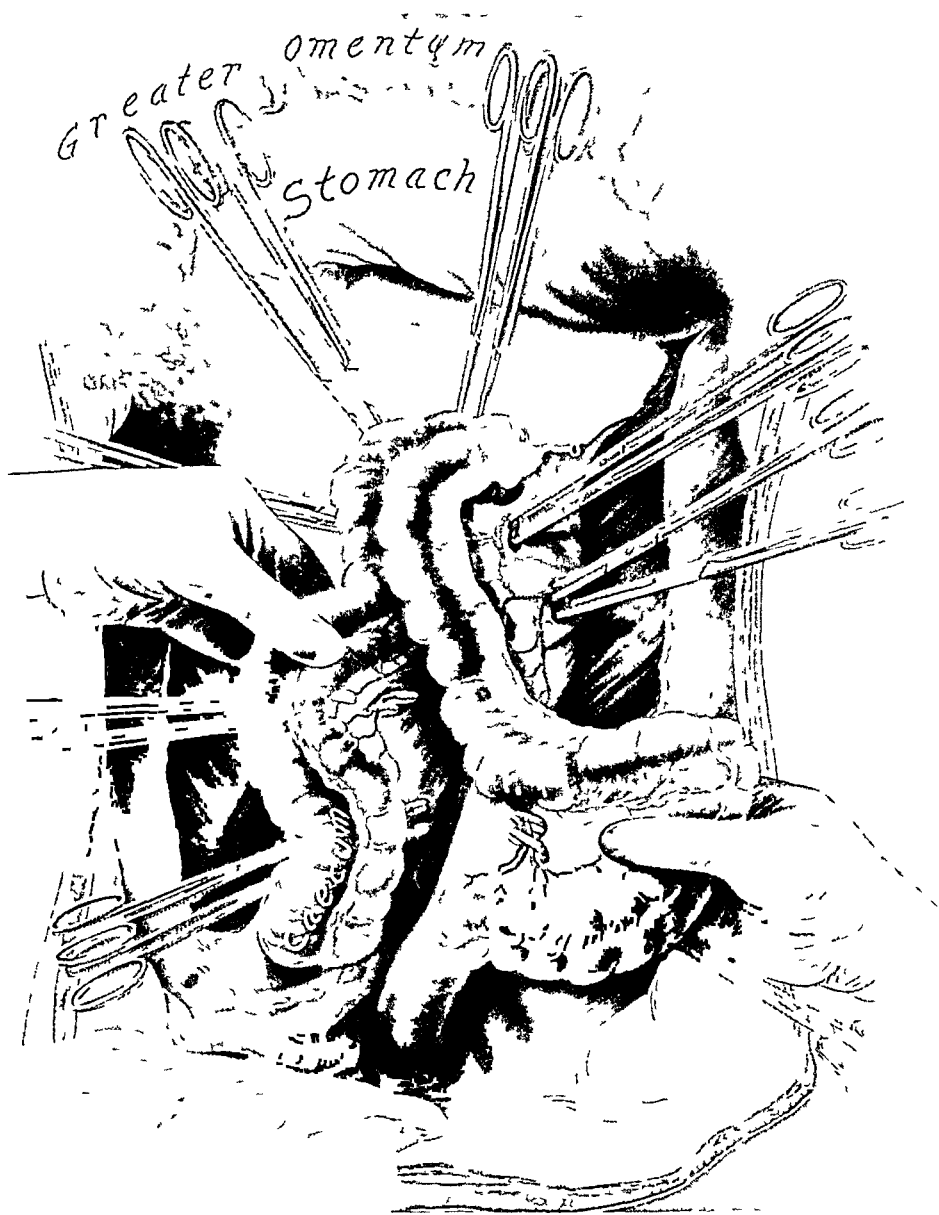


FIG 7 —The entire large intestine is now easily pulled out through the abdominal wound. All the large vessels are in plain view and may be clamped and cut between the clamps.

which apparently is as large as a small hen's egg. There are numbers of ulcerating areas varying in size from a pin point to large ulcers (one large ulcer near the anus). Considerable bloody fluid. Entire wall injected and covered with much mucous. Upon examination the warm stool showed no amœba. Diagnosis: Colonic polyposis. Examination of the blood at that time did not show very great anæmia. On July 24, 1922, the patient was taken to the operating room of the Portland Surgical Hospital with the pre-operative diagnosis, "Multipolypoid growths in the rectum, one of which is very

COLONIC POLYPOSIS WITH ENGRAFTED MALIGNANCY

large" Operative findings "Many polyps, varying in size from lima bean to an egg, discovered in the rectum and sigmoid" Operation "Large tumor in rectum with underlying intestinal wall was removed Specimen was examined by Doctor Foskett under frozen section, pronounced papillo-adenocarcinoma The abdomen was then opened Large masses of polypoid growths were found occupying the entire length of colon, being most abundant in the transverse colon The recorded statement of the operator was "In consideration of the pathological findings in the large papilloma removed, it will be necessary to remove the entire colon At this operation the intestinal limbs forming a loop of ileum are sewed together and brought through a stab wound in the right rectus muscle to be opened later as an ileostomy A small strip of skin passes under the loop Ileum will not be opened until the colectomy is done unless it becomes a necessity Colectomy will be done in week or ten days"

Upon going over the specimen more carefully, the final pathological report was as follows 'Gross description The tissue consists of masses of soft flexible cauliflower growths No hard nodules are found Paraffin section diagnosis The growth consists of branching cauliflower-like processes each of which is covered by a single layer of tall cylindrical cells These processes are highly vascular The wall of the rectum is apparently not invaded by the growth although the epithelium is slightly irregular in growth at the base of the processes This

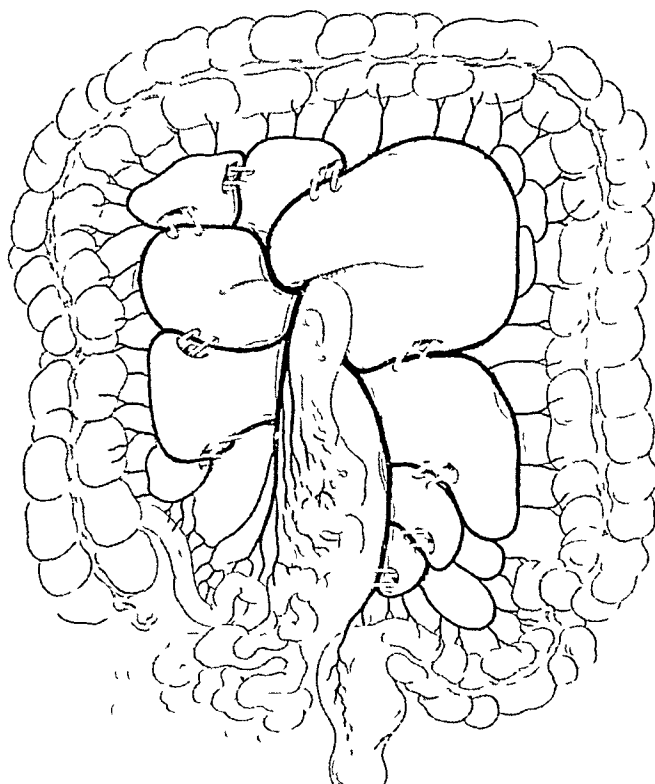


FIG 8—Diagram showing the colon dropped back into its normal position, tips of forceps coming in from behind

is not definitely malignant Papillomata of the rectum are, however, to be regarded as a potential cause of adenocarcinoma Robert L Benson"

After receiving this report, it was decided to let the patient go home with the ileostomy, the understanding being that she would return once every six months to have the rectum examined This she did faithfully There was no apparent change in her condition and no apparent change in the growth in the rectum until she returned November 21, 1924, two years and four months after the ileostomy was performed At that time, the rectal growth showed evidence of decided extension The hæmoglobin was 78 per cent, the patient felt herself gradually going down It seemed quite certain that the growth in the rectum was taking on malignancy Therefore, the patient was advised to have a complete colectomy performed The pre-operative diagnosis was "Polyposis of the large intestine Carcinoma of the rectum" Operative findings In the midst of the mass of polyps in the rectum, there was an induration which had the appearance of malignancy At the lower angle of the former abdominal incision a hard, fibrous tumor mass was found It has the appearance of a malignant transplant (Unfortunately no record can be found of the pathological examination of this specimen) It is difficult to see how a transplant could have occurred from the former

abdominal operation in as much as no intra-abdominal tissues were removed at that time. In addition to these two growths, there was another obstructing, annular growth in the descending colon just below the splenic flexure which had the appearance of undoubted malignancy. The entire large intestine from the cæcum down including the ascending, transverse and descending colon and sigmoid, as well as the rectum, were found studded



FIG. 9 —Vessels have all been severed and ligated. Clamps on the ileum and sigmoid ready for final removal with polyp. The transverse colon contained the largest mass. Here the intestine was as large as the middle part of a man's forearm and was filled with a polypoid mass. Some of the lymphatic glands in the transverse mesocolon were as large as black walnuts but they seemed to be of an inflammatory character. No adhesions had followed the former operation except a slight adhesion of the omentum in the neighborhood of the ileostomy wound.

COLONIC POLYPOSIS WITH ENGRAFTED MALIGNANCY

A technic for removing the entire colon, including the rectum which was used in this case, may be stated as follows "An incision is made along the inner edge of the right rectus muscle to a point above the umbilicus. A transverse incision is then made from this point across the left rectus, making an "L" incision. The peritoneum external to the ascending colon is cut and the hepatic flexure mobilized. The peritoneal attachment of the omentum to the transverse colon is clipped, thus opening the lesser peritoneal cavity and exposing the posterior surface of the stomach (Fig 2). The dotted line continuing from the point

of scissors indicates how the omentum is further mobilized entirely across the abdomen. The costo-colic ligament is cut and the peritoneum external to the descending colon and all the way down to the sigmoid proper is cut. This mobilizes the ascending and descending colon from the posterior abdominal wall and the omentum from the transverse colon (Figs 3, 4, 5 and 6). The intestine, from the ileum to the sigmoid, is now easily lifted and pulled out through the abdominal incision. The vessels external or posterior to the mesocolon are standing out in plain view and may easily be clamped

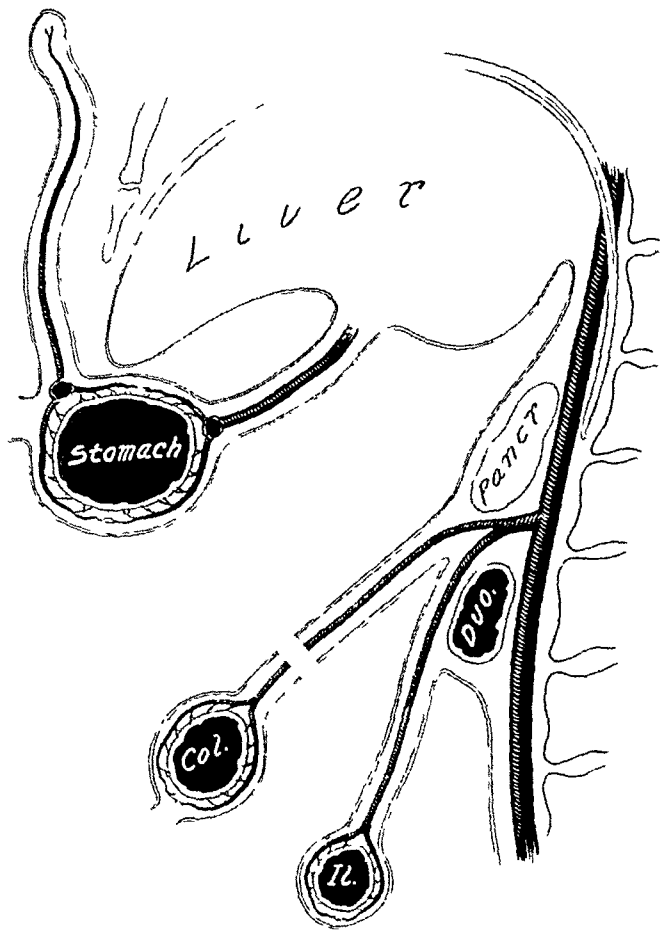


FIG 10 —Omentum severed from transverse colon completely opening up lesser peritoneal cavity

with artery forceps from the external or posterior surface of the mesentery (Figs 7 and 8). The vessels are then severed between their clamps and the partially detached intestine is delivered through the abdominal wound. The proximal ends of the vessels held in clamps are firmly ligated leaving the raw bed of the ascending and descending colon and the ligated vessels in the mesenteries exposed (Figs 9 and 10). The double clamps on the sigmoid and on the ileum are allowed to remain in position without opening the intestine until all abdominal suturing is completed down to the promontory of the sacrum. A continuous catgut suture now begins at the point from which the cæcum has been removed. The bed of the ascending colon is covered over by continuous suture. The omentum is

drawn down in the continuous suture and sutured to the lower peritoneal leaf of the transverse mesocolon, entirely across the abdomen, thereby closing and restoring the lesser peritoneal cavity. The suture is then continued until the bed of the descending colon is closed. The superior hemorrhoidal vessel is now doubly ligated and severed as it crosses the promontory of the sarcoma. With a long-handled scissors curved on the margins and with a probe point on the under blade, the peritoneal leaves of the mesosigmoid are severed all



FIG. 11.—Peritoneum of the mesentery now brought over to the lateral edge of peritoneum. The omentum is brought down and sutured to the mesentery which gradually reestablishes the lesser peritoneal cavity.

the way down to the cul-de-sac where the incisions meet in front of the rectum. The fingers of the left hand are now insinuated between the sigmoid and the sacrum so as to separate all the fat and glands in the hollow of the sacrum down as far as the tip of the coccyx, just as if an operation for primary cancer of the rectum were being done. A rectal tube has previously been passed, to the end of which the inverted portion of the sigmoid is sutured by one strong suture. A nurse now pulls on the rectal tube and the end of

COLONIC POLYPOSIS WITH ENGRAFTED MALIGNANCY

the sigmoid is drawn out through the anus, thus producing an intussusception. A stab wound is made in the upper end of the vagina, a drain is placed through this opening into the hollow of the sarcoma so as to cover the invaginated end of the sigmoid. If the patient is a woman the uterus is now tilted backward and made to form a roof for the lower pelvis which has



FIG. 12 —The line of suture is continued down the left side. Superior hemorrhoidal artery severed. distal end of sigmoid is closed with a purse-string the end is attached to a rectal tube in the rectum. By pulling on this tube the sigmoid is drawn out through the rectum. (See operation for cancer of the rectum.)

been drained and at the same time to form an unbroken floor for the abdomen (Figs 12, 13, 14 and 15)

About ten days after this first operation, if the patient is in good condition, the inverted rectum may be removed. In the female, the vaginal mucosa is split down to the rectal mucosa, the perineal body is cut, an incision is made far around the anus which permits of the removal of all the anal muscles. The fingers are then inserted along the vagina through the drainage tract and

the rectum and all the fat, and including the anal muscles, are peeled out, as shown in Figs 9 and 10, pages 505 and 506, of the article on "Treatment of Cancer of the Rectum," published in *ANNALS OF SURGERY*, October, 1922. The perineal body is sutured. The recto-vaginal septum is not sutured. The cavity in the hollow of the sacrum and ischio-rectal space lying above the perineum is packed with gauze, which remains for three or four days, after which the wound is permitted to heal. If the patient be a man, the drainage

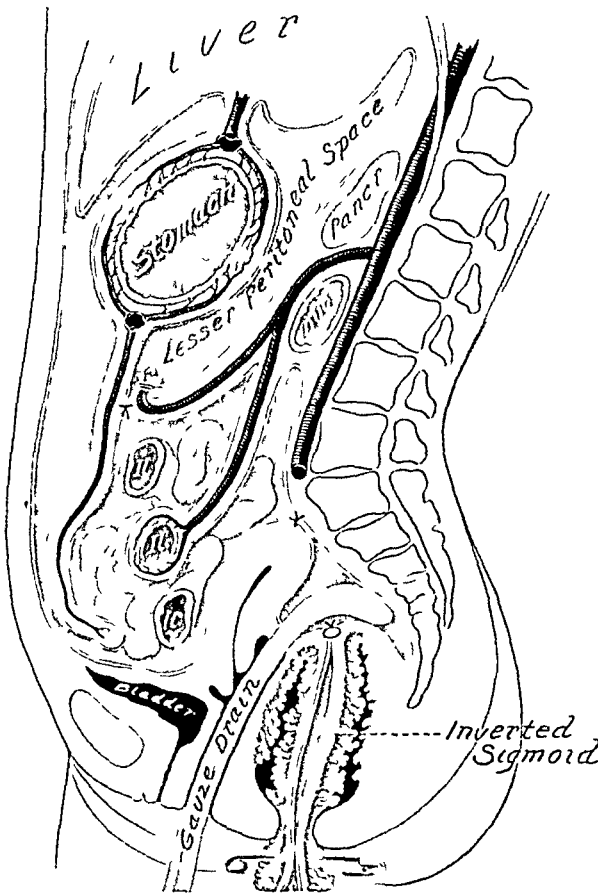


FIG. 13.—Segmental view showing the relation of the patient's abdominal organs and cavities after operation of anatomical complete colectomy. The rectum remains for another operation which can be done by splitting the vaginal wall or taking off the coccyx. In either case the operation is very short, requiring only 5 or 10 minutes. This operation was performed when the colored specimen entitled "colonic polyposis" was removed. Patient is alive and well over a year after operation.

will have been placed as shown in Figs 6 and 8, pages 503 and 505, respectively, and the removal is shown in Figs 11 and 12, pages 507 and 508, of the article on "Treatment of Cancer of the Rectum," published in October, 1922, *ANNALS OF SURGERY*.

In the case I have reported, the major operation of colectomy was performed on November 22, 1924, and the rectum was removed on December 2, 1924. I have recently seen the patient and examined her. She is in perfect health and is comfortable. No evidence of recurrence. I have treated two similar cases in past years by temporizing surgical measures of one kind or another and in both instances the patients died

without completion of any satisfactory treatment. Having had a year to think of this case since this operation, the conclusion has been reached that all the surgical demands involved in the situation are met in this procedure.

Lockhart-Mummery has the following to say concerning the radical surgical treatment of colonic polyposis: "The disease is a very serious one. The patient suffers from severe and intractable diarrhoea and bleeding. There is often severe and distressing tenesmus, and rapid loss of weight and wasting. Moreover, there is every probability that cancer will develop, if it has not already done so."

COLONIC POLYPOSIS WITH ENGRAFTED MALIGNANCY

"Under these circumstances any operation would seem justifiable that affords a possibility of removing the disease. The only method that offers any reasonable prospect of dealing adequately with it is resection of the entire colon. This was done in Lilienthal's case after a previous ileo-sigmoidostomy,



FIG 14—Uterus tilted backward, entire abdomen closed off. On the right side of the patient the loop of ileum forming the ileostomy is seen passing through abdominal wall. Note that the lesser peritoneal cavity has been completely closed off.

and the patient recovered. This was probably the first instance in which resection of the entire colon was performed.

"Unfortunately, the rectum is usually affected together with the colon, so that the whole of the disease cannot be removed, but if the anastomosis is made low down, the polyps in the rectum could in most cases be removed later, and at any rate, this operation seems to be the only one at all worth considering.

"The following case is, I believe, the only one in which complete colectomy has been done as a primary operation for this condition." The

operation is reported as having taken place March 18, 1918, at which time "the ileum was divided near the cæcum and its proximal end anastomosed to the distal third of the pelvic colon. The entire colon above was then excised. Further operation was performed on April 22 and the rectum cleared of polypi through an operating sigmoidoscope. The patient made a good recovery, and was discharged on May 17, 1918." Her condition

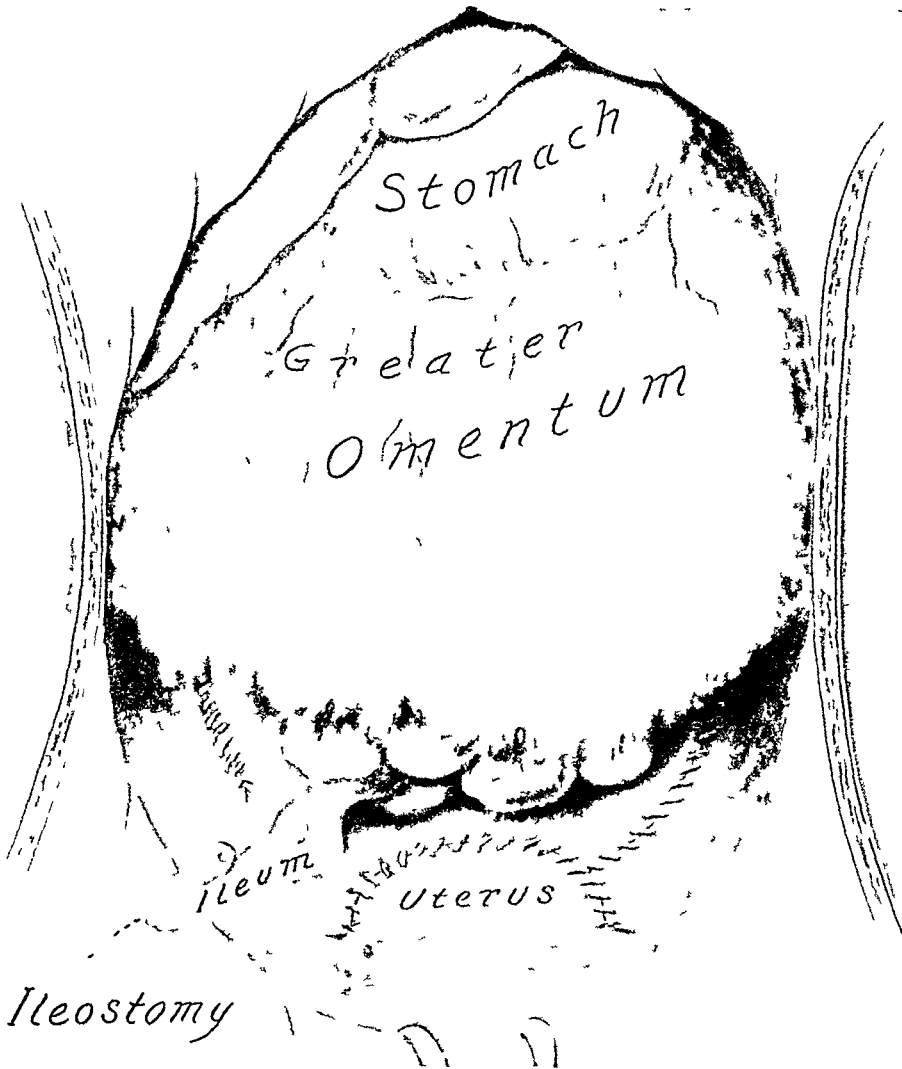


FIG. 15 — Normal relation in the abdomen following complete colectomy. The omentum drops down over the small intestine in a normal way.

remained well and satisfactory up to the time his book was published in 1923. He makes the further remarks:

"Resection of a cancer of the colon which is found to be associated with multiple polypi is apparently not worth doing unless the rest of the colon is either removed at the same time or subsequently. The evidence available seems to show that cancer will recur in some other part of the colon if it has not already done so."

It is at once apparent that the operation performed by Lilienthal and the

COLONIC POLYPOSIS WITH ENGRAFTED MALIGNANCY

one performed by Lockhart-Mummery were not applicable in such cases as the one I have just described on account of the multiple malignancies. I think even without the malignancy that it would have been impractical to have performed any other operation than the one that was performed when one considers the massive polypoid involvement of the rectum and sigmoid.

Before closing this discussion, I would like to stress some of the anatomical and physiological points in connection with the operation of complete colectomy. To do a complete colectomy on the

quadruped, notably the dog, is much simpler than to do it on the human being, for the reason that the large intestine has a long mesentery throughout its entire length. In the human being certain prenatal fixations have taken place. The ascending and descending colon have fused with the posterior parietal peritoneum and are thereby fixed. The omentum, as it has grown down over the transverse colon, has become attached to the front surface of the human intestine. It is well to note that this attachment is only fusion or adhesion of two peri-

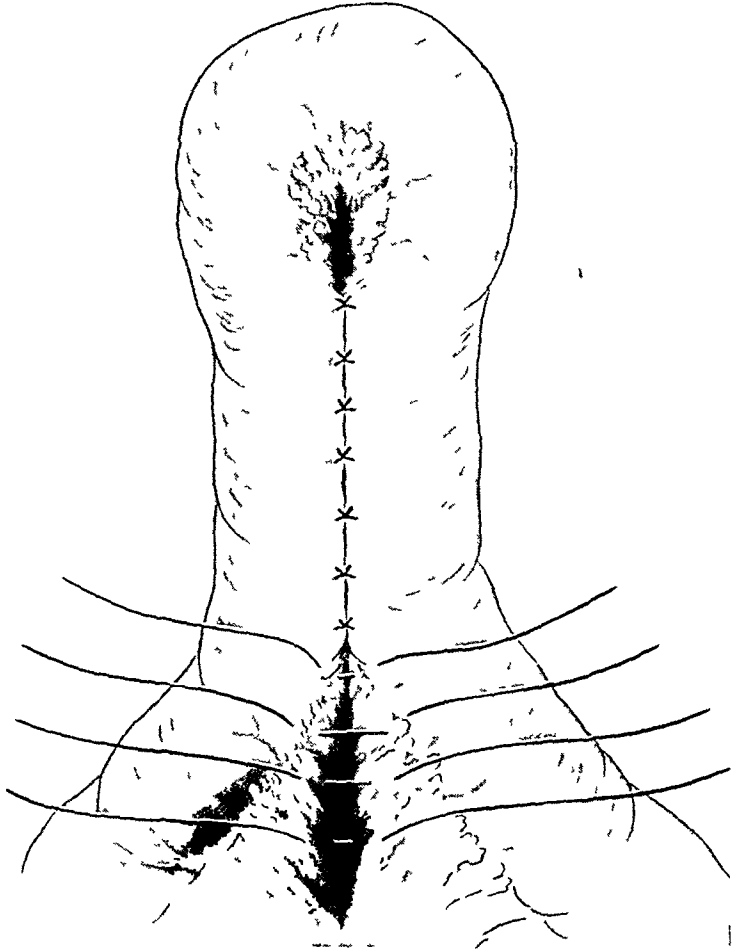


FIG. 16.—Limbs of loop of ileum sewed together at the mesenteric border with interrupted linen sutures. Mesenteric angle being closed with untied sutures.

toneal surfaces and that there are no important vessels connecting the omentum with the colon. Therefore, it is a very simple matter to detach the omentum from the colon without injuring either the omentum or the colon. By thus freeing the omentum, the lesser peritoneal cavity is laid open. The transverse colon has a long mesentery. Therefore, after the peritoneum has been cut external to the ascending and descending colon and the omentum has been severed from the transverse colon, the entire large intestine is easily drawn out through the abdominal wound (Fig. 7) where the vessels can be clamped and ligated (Fig. 7). In short, if we will remember the special prenatal fixations peculiar to the embryological development of the human being, we will at once see that the most important part of the operation of colectomy

is that the special prenatal fusion shall be undone and the mesenteric attachments reduced to the quadruped or canine stage

In deliberately planning this operation, I think it would probably be well to do the operation in three stages, just as we have done in this case, except that the interval between the ileostomy and colectomy should be, of course, much shorter and the length of time adjusted to suit the case in the judgment of the operator. Of course, it will at once be apparent that the protec-

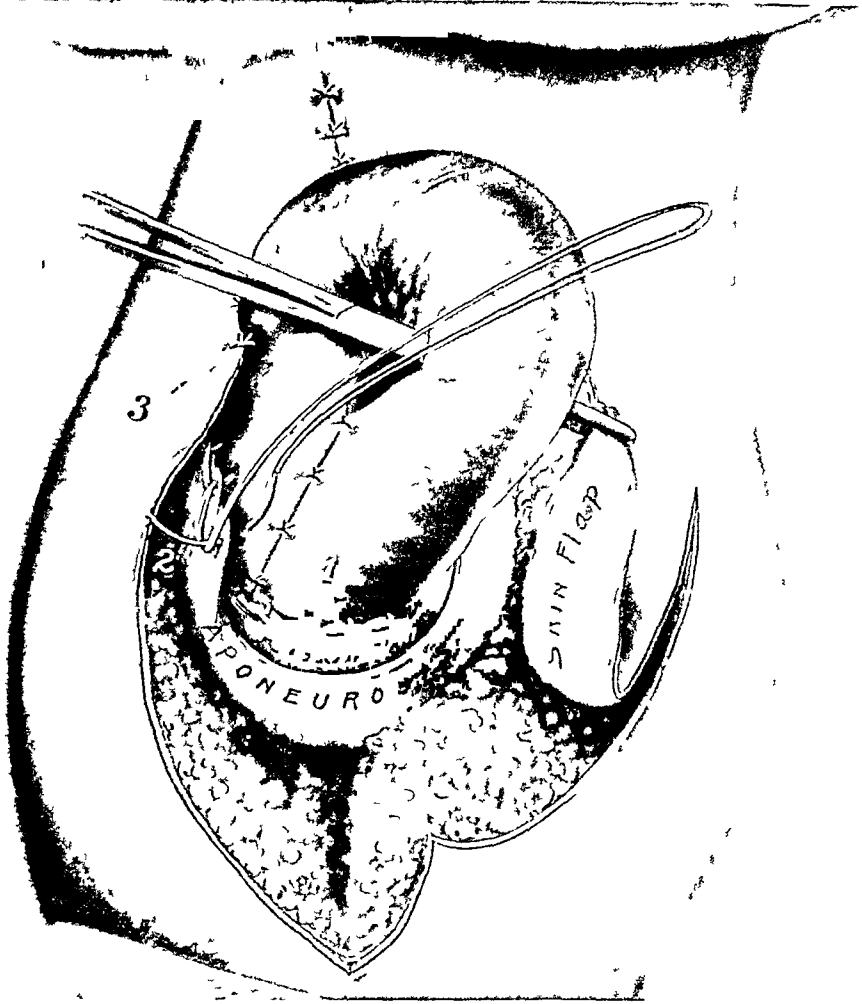


FIG. 17.—Loop of bowel brought through stab wound in right rectus. Peritoneum aponeurosis and some muscle fibres sewed around the loop with button-hole stitch of fine chromic catgut. Strip of skin being drawn through the mesentery of the intestinal loop. Skin flap being drawn through intestinal loop to be sutured to skin on opposite side.

tomy should be left for a separate operation, just as we have recommended for removal of carcinoma of the rectum ordinarily. The question may be asked, "Why do the ileostomy at a separate operation?" It may in the majority of cases be unnecessary. Yet, in the extremely emaciated, exhausted patient, it is often very important to conserve every possible force. In doing an ileostomy, it is necessary to remember that according to physiologists, the cæcum normally absorbs from 80 to 90 per cent of the fluids. When the ileostomy is first made the discharge is very thin, contains a great deal of bile

COLONIC POLYPOSIS WITH ENGRAFTED MALIGNANCY

and other intestinal secretions, and is very irritating to the skin. All of this 80 per cent of fluid, which should be reabsorbed in the cæcum, is poured out through the ileostomy opening. As the days and weeks go by, the small intestine takes on the function of the cæcum and absorbs these extra fluids until within a short time in the average case, the discharge from the ileostomy is of semi-solid or mushy consistency. In other words, a normally functioning abdominal mechanism has been established. It would appear that by turning out this thin watery discharge of fluid and intestinal secretion, a very weak patient would be further depleted by this loss and the patient's chances for recovery following such an enormous operation might be decidedly reduced.

Another point which is very important in considering a permanent ileostomy may be mentioned. To Dr. John Young Brown, more than any one else, must be given the credit for having demonstrated and urged the practicability of an ileostomy and its advantages over a colostomy when it can be used. My head nurse recently asked the question, "Why do you not always do an

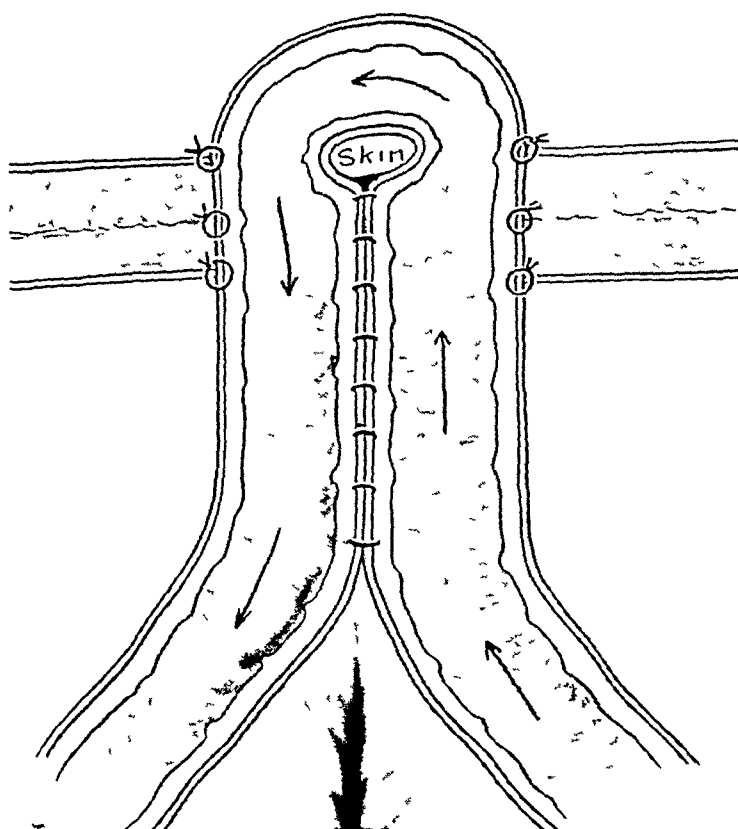


FIG. 18.—Sectional view of loop showing attachment to layers of the abdominal wall. Skin strip supports loop from beneath. The sutures between the limbs prevent undue prolapse of intestine.

ileostomy rather than a colostomy? The ileostomy is so much more comfortable for the patient, is so much less care and is entirely devoid of odor while a colostomy is always an offensive affair." Of course, I had to explain the ileostomy was not always practical. Brown had cases in which permanent ileostomies had existed ten to fifteen years, patient maintaining perfect health all the time. I have several cases in which the ileostomy opening has functioned for several years. As far as may be determined from these cases, the colon is not essential to the perpetuation of human life and health. However, there is a very great difference in the way an ileostomy is performed. If a loop of bowel is simply brought out in an aimless sort of a way and attached in the abdominal wound, an ileostomy may be a very inconvenient opening in that there is a tendency to formation of a hernia of the mucous membrane and even the intestine. This is entirely prevented by the following technic

If the abdomen has been opened for exploratory purposes, a loop of intestine 8 to 12 inches long is lifted up and the two limbs of the loop sewed together near the mesenteric border for a distance of about three inches. At the apex of the loop a small space is left through which an artery forceps is thrust for the purpose of drawing a narrow, mobilized piece of skin from the edge of the abdominal incision through the mesentery just beneath the intestine but just above the line of intestinal sutures. This is done after the

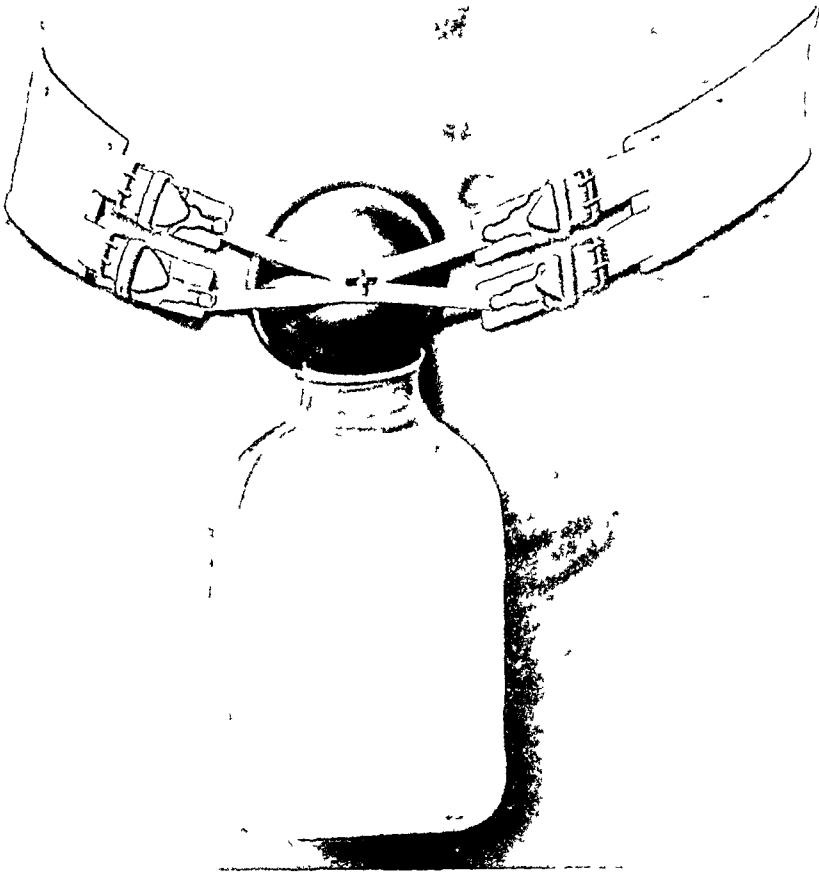


FIG 19 —Delatour colostomy bag (Tiemann and Co New York)

intestine has been drawn out through a small stab wound and its wall has been fixed to the deeper layers of the abdominal wall. In this way it is impossible for the intestine to draw in or push out. Therefore, after the intestine has been opened as much of the mucous membrane can be destroyed as is necessary to make a convenient inconspicuous opening.

HÆMOSTASIS IN SUPRAPUBIC PROSTATECTOMY*

BY VERNE C HUNT, M D

OF ROCHESTER, MINN

FROM THE DIVISION OF SURGERY OF THE MAYO CLINIC

DURING the last twenty-five years there have been radical changes in both the suprapubic and perineal methods of performing prostatectomy. In the early years of prostatic surgery, the results of the operation were judged only by the return of voluntary urination. However, as the indications for prostatectomy have broadened and included, besides the cases in which voluntary urination was impossible,

those characterized by intermittent acute retention, large or small amounts of residual urine, and frequency of urination, the results of operation have been determined not only by the return of voluntary urination, but in terms of the physiologic function of the bladder. With the improvements in the operation, the ultimate functional results of the perineal and suprapubic methods have been equally good when performed by those skilled in the respective methods. Until recent years the perineal operation has probably

been accompanied by a lower mortality rate than the suprapubic, as a result of the modifications contributing to the safety of this method presented from time to time by Young, Geraghty, Hinman, Davis, and others. On the other hand, suprapubic prostatectomy has recently been modified and made safer so that there is now little choice between the two methods from the standpoint of ultimate functional results and mortality rate.

The mortality rate in this field of surgery depends on pre-operative preparation, the type of anæsthesia, and hæmostasis. My own experience,

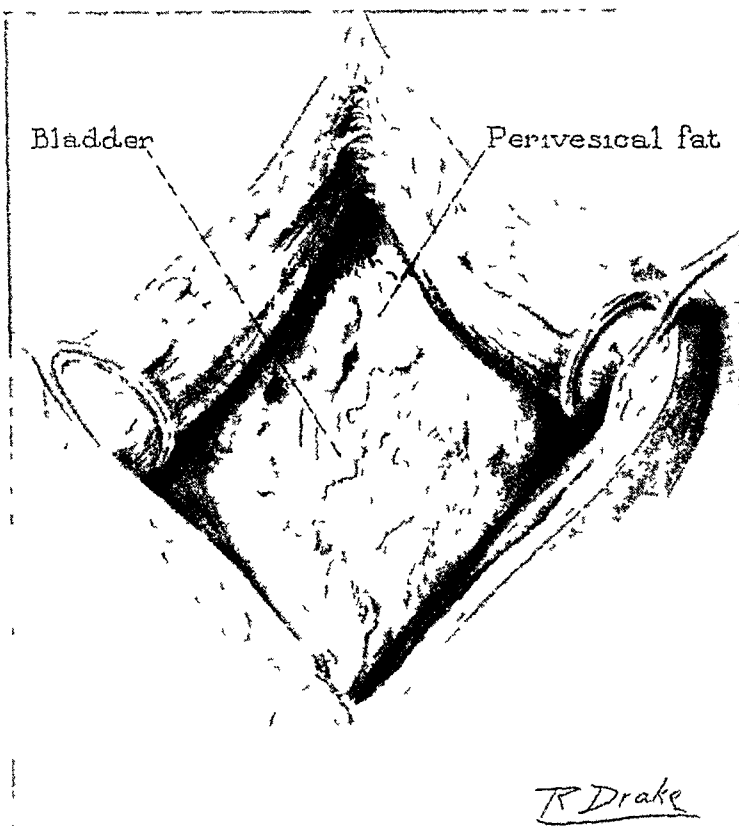


FIG 1—Exposure of the bladder, it is identified by its muscular structure. Distention unnecessary.

* Read before the North Central Branch of the American Urological Association, December 11, 1925

reported elsewhere,⁹ has shown that the surgical mortality rate has been almost as high in those cases of prostatic obstruction in which the surgical risk being regarded as slight, no pre-operative treatment was undertaken, as it has been in the cases in which the surgical risk was great and adequate treatment was instituted preliminary to prostatectomy. Unquestionably there is a distinct relationship between pre-operative treatment and mortality rate, and this has led to the adoption of a routine of pre-operative preparation in all cases of prostatic obstruction, this consists primarily of drainage of the bladder.

The depressant effect of anæsthetics on the kidneys has been obviated and

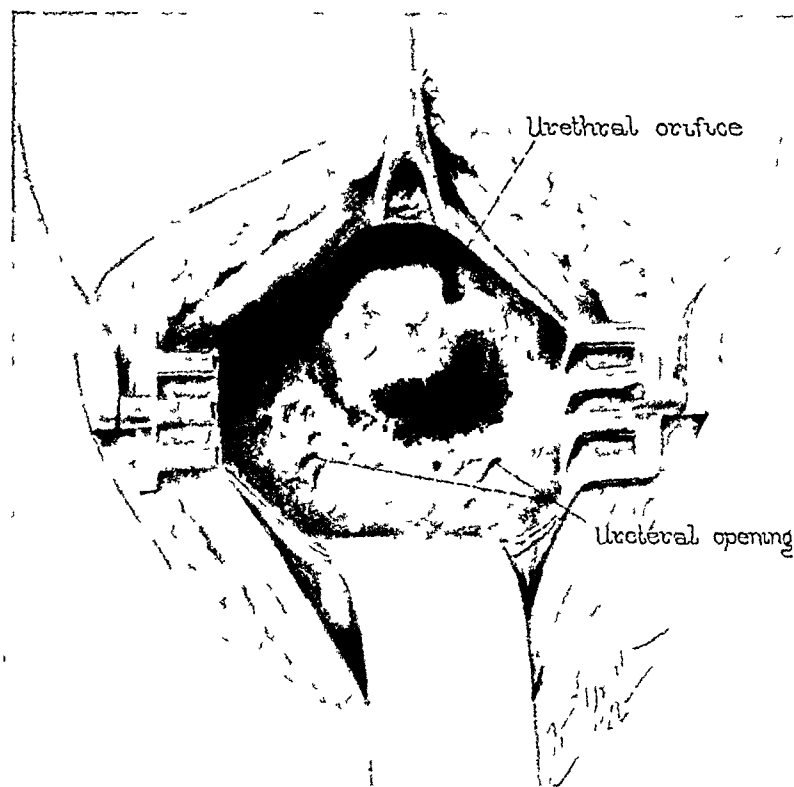


FIG. 2.—Visible prostate and interior of bladder

the incidence of post-operative pulmonary complications largely eliminated by avoiding the inhalation types of anæsthetic. Regional anæsthesia is effective and possesses none of the disadvantages of general anæsthesia.

Hæmostasis in performing prostatectomy has not been given the consideration it has received in other fields of surgery. The effects of loss of

blood after prostatectomy have been minimized. However, no single factor so lowers the resistance to infection and depletes the organic reserve as continued loss of blood after operation. It has been accepted without protest, and with little thought of its effects, that bleeding from the prostatic cavity for several days is but a natural and unavoidable sequel to removal of the gland, whereas the same loss of blood after operation in other fields causes considerable concern.

Various methods have been utilized tending to control bleeding partially, and ultimately decrease the total loss of blood. Massage of the prostatic capsule immediately after removal of the gland has controlled, to some extent, bleeding from the interior of the capsule. Irrigation of the capsule with hot solutions, such as boiling water, boric acid solution, and hot bichlorid solution,

probably first suggested by McGill in 1888, has been used. Packing the capsule with fat, in the expectation that it will subsequently be absorbed, has been advocated. Ingenious methods of maintaining tampons in the capsule by sticks protruding through the suprapubic wound¹ to facilitate pressure, which are removed subsequently, and methods of suturing the capsule have accomplished a certain degree of hæmostasis. Thromboplastic substances, chiefly kephalin, have served to control post-operative bleeding partially. Before the advent of the Hagner bag and Pilcher's modification, the best means of controlling bleeding from the prostatic capsule was in my experience to pack the capsule with iodoform gauze, and allow it to remain in place for several

days. However, while this has been effectual for the most part its effectiveness is the result of the gauze becoming enmeshed in the granulation tissue of the prostatic capsule, when it is removed bleeding of variable degree is often precipitated and occasionally severe secondary hemorrhage has resulted.

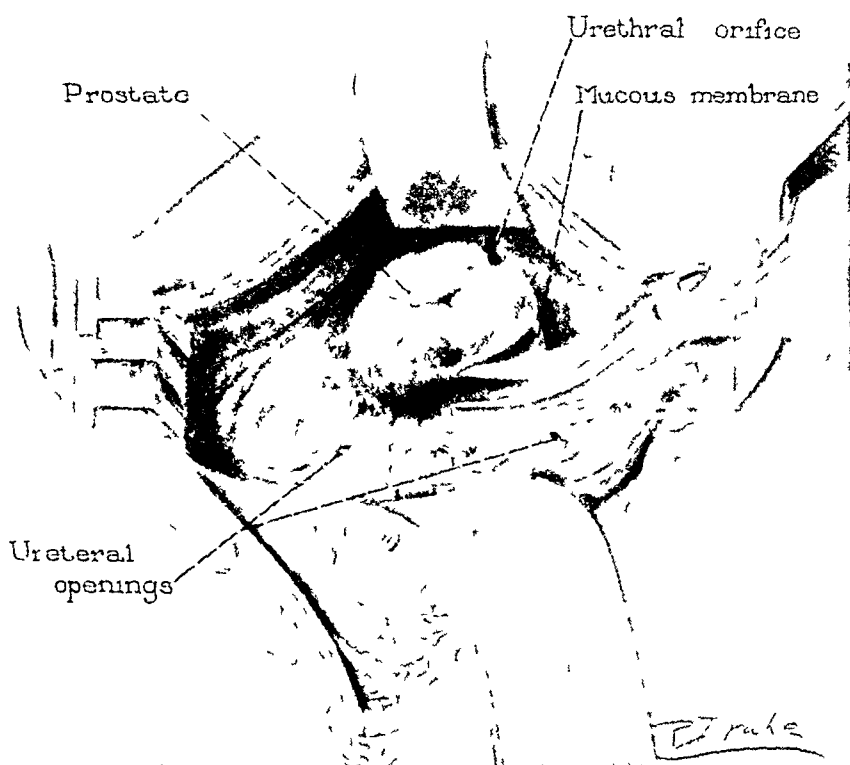


FIG. 3.—Incision of mucous membrane overlying the intravesicle portion of the prostate obviates irregular tearing of mucous membrane by blunt dissection.

The one-stage operation affords

exposure and visualized conduct of the operation, which are principles so necessary to accuracy (Figs. 1, 2, 3, 4, 5). The operation in a visible field gives opportunity for the placing of interrupted sutures (Fig. 6) at the vesical neck, the importance of which has been emphasized by Cabot, Judd, Walker, and others. Inasmuch as 75 per cent of patients, when carefully prepared by permanent urethral catheter, may be operated on with safety by the one-stage visible operation, all bleeding from the vesical neck may be accurately controlled by suture. However, the interior of the prostatic capsule is not accessible for the control of bleeding by suture and ligature, as in other fields of surgery.

The bag presented by Hagner answered a distinct need and served as an excellent means of hæmostasis within the prostatic capsule. It possessed the advantage of not precipitating bleeding with its removal. Pilcher's modifi-

cation of the Hagner bag provides for urethral drainage of the bladder, its contour conforms well to that of the prostatic capsule, and it offers a means of providing traction on the bag to maintain it in position. Either bag is more effective in controlling bleeding from the prostatic capsule than any other method previously presented.

While the bag may be used to advantage in both one-stage and two-stage operations, the operation in a visible field allows control of bleeding by suture at the vesical neck and accurate placing (Fig 7) of the bag so as not only to control the capsular bleeding, but also to supplement the hæmostasis by suture of the vesical neck. It has been my experience that it is inadvisable to place

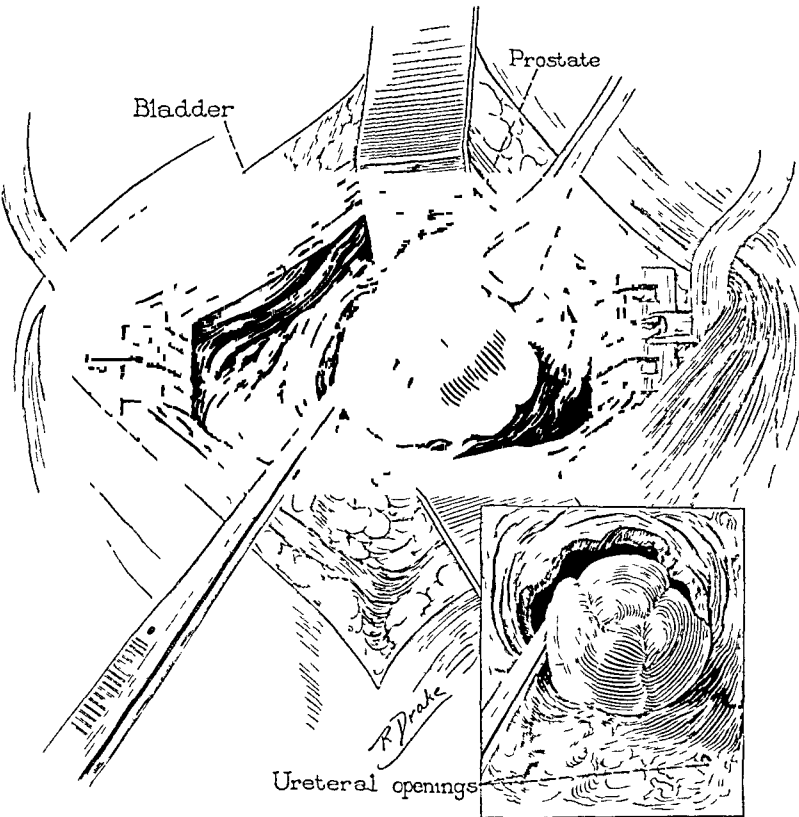


FIG 4 —Visible forceps method of enucleation of the gland

and is easily removed. While air has been recommended for inflation of the bag, I have found water preferable, for the volume can then be measured and the degree of inflation more readily controlled than it would be by the use of air.

Considerable difficulty was encountered in my early experience with the bag, particularly as regarded the amount of its distention, the amount of traction necessary to oppose vesical tenesmus and to maintain the bag in position, without causing post-operative incontinence, and the maintenance of that traction without variation. The amount of distention necessary is not constant, but varies with the size of the prostate and the size of the capsule after removal of the gland. Excessive distention of the bag is not essential to the complete control of bleeding and may exert a harmful effect

the Pilcher bag entirely within the prostatic capsule, the best results being obtained when it is allowed to impinge on the vesical neck (Figs 8 and 9) or internal sphincter. Inflation of the bag in this position affords perfect hæmostasis without necessitating the use of gauze as well, the bag tends to remain in position with moderate traction

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on the sphincters of the bladder, overdistention of the bag may cause it to thin out in one portion with subsequent rupture and defeat of its purpose. The maximal distention to which a bag may be subjected is that of about 180 c c of water, which exerts a pressure equivalent to about 140 mm of mercury within the prostatic capsule. This amount of distention is rarely necessary even after removal of the largest glands. The minimal distention for the smallest prostatic capsule for complete hæmostasis is that produced by about 60 c c of water, which exerts a pressure of about 60 mm of mercury. After removal of the average-sized gland, rarely is more than 120 c c of water required, and

pressure varying between 60 and 80 mm of mercury is sufficient to control bleeding from the prostatic capsule and vesical neck.

It is important not to distend the bag any more than is just sufficient for complete control of bleeding.

Unless the bag is allowed to lie entirely within the prostatic capsule, which decreases the effectiveness of its control of bleeding from the

vesical neck, some form of traction is necessary to maintain the bag in position and prevent the effect of vesical spasms on its position. Strapping the urethral tube of the Pilcher bag to the thigh provides traction which is not constant but varies with the position of the thigh. Hamer has devised a method of maintaining a constant and invariable degree of traction in the form of a pubic or perineal tripod, a modification of which I have always used with the Pilcher bag (Fig 10). This maintains a constant and invariable degree of traction by virtue of the unchangeable distance between the bag and the point of fixation of the traction. In my early experience with the bag and this means of maintaining traction, about 25 per cent of the patients experienced temporary post-operative incontinence which in several instances persisted as long as

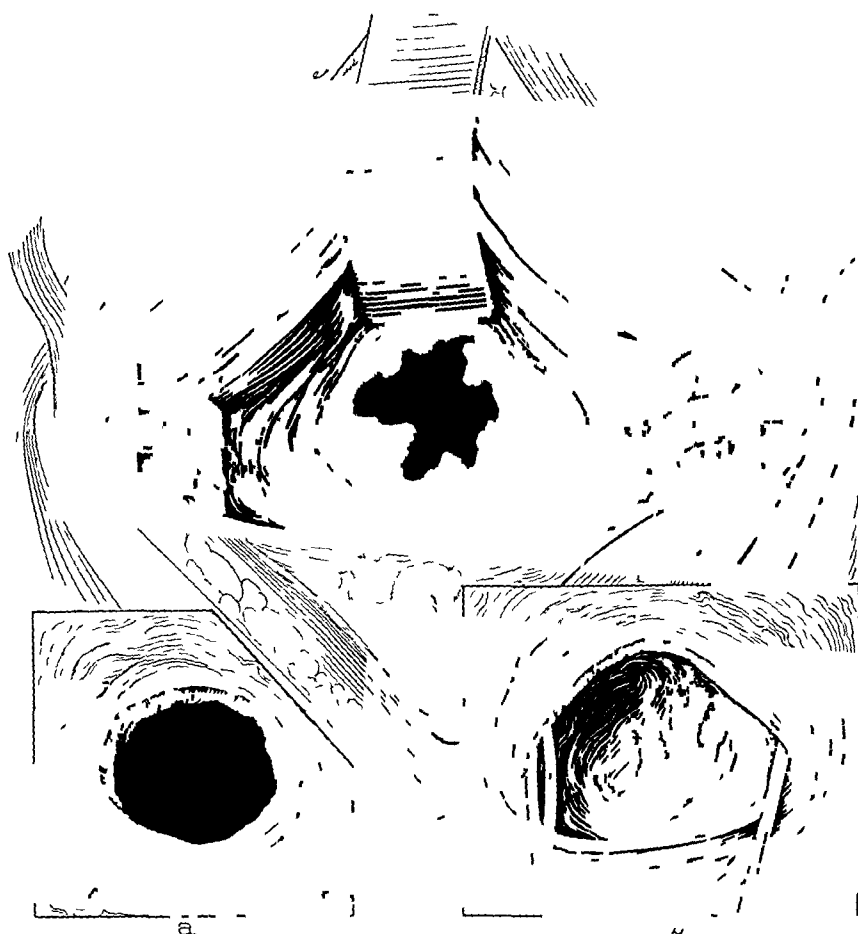


FIG 5—Large figure shows irregular neck of bladder following blunt dissection at vesical neck. a Vesical neck resulting after visible incision (Fig 3) b Interior of prostatic capsule

four months, control was eventually totally restored, except in two instances in which it has been permanent. However, in neither of these cases, after reexamination, has the possibility of a lesion of the cord been excluded. Utilizing the urethral tube for traction requires extreme force, by virtue of its elasticity, to maintain the bag in position, and as traction is made on the urethral tube its force is exerted as a pull directly at the apex of the bag and against the external sphincter. In this way subsequent sphincter control is jeopardized. To obviate elastic traction and the exertion of its force as a pull on the apex of the bag and directly against the external sphincter, a heavy silk strand (Fig 8) is threaded through the urethral tube and attached to the

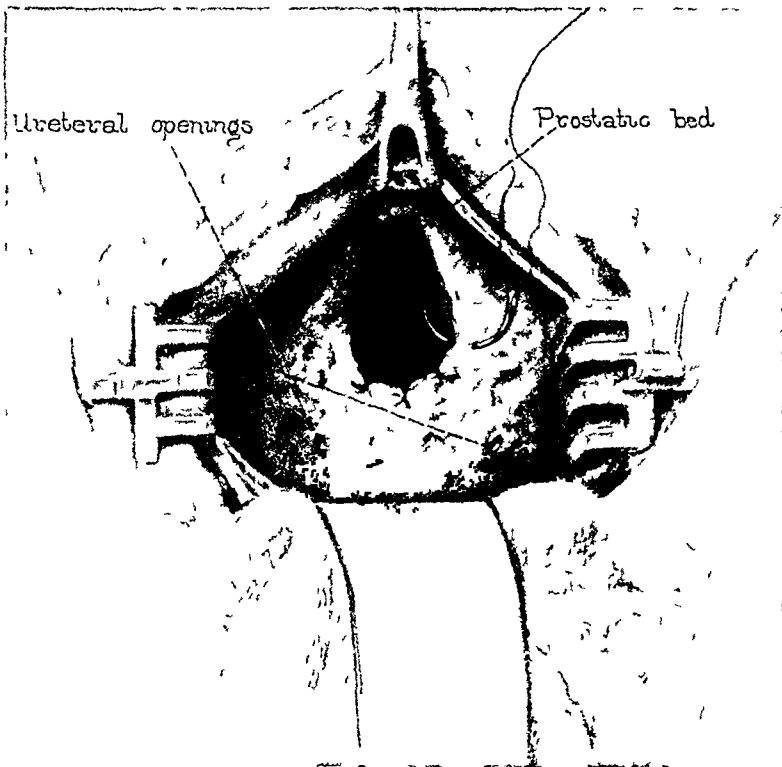


FIG 6 — Interrupted suture haemostasis at neck of bladder

ring in the base of the bag. Only sufficient traction is made on the strand to draw it tight, traction being exerted on the base of the bag instead of its apex so that its effect is converted into intravesical pressure on the base of the bag. Since in approximately 75 per cent of the cases of surgical benign prostatic hypertrophy there is intravesical enlargement with

resultant dilatation of the internal sphincter, I hardly believe that allowing the bag to impinge on the internal sphincter and exerting pressure on it to maintain the position of the bag adds materially to the risk of subsequent failure of function of the internal sphincter. Conservation of the external sphincter is most important in the operation of prostatectomy. Exerting traction in this manner does not jeopardize the subsequent function of the external sphincter, provides inelastic traction, allows no variation of the position of the bag as a result of tenesmus, and accomplishes the maximal haemostatic effect in the prostatic capsule and vesical neck.

The urethral tube extends through the bag but serves a better purpose for the passage of a thread to maintain traction than for drainage of the bladder while the bag is in place. Consequently it is necessary to provide suprapubic

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drainage during this time This is best accomplished by means of the ordinary No 30 male catheter and accurately closing the bladder around it Besides providing drainage the catheter leaves a sufficiently large opening, after its removal, for the withdrawal of the collapsed bag

It is not necessary to maintain prolonged suprapubic drainage when hæmorrhage has been accurate It prolongs unnecessarily healing of the wound

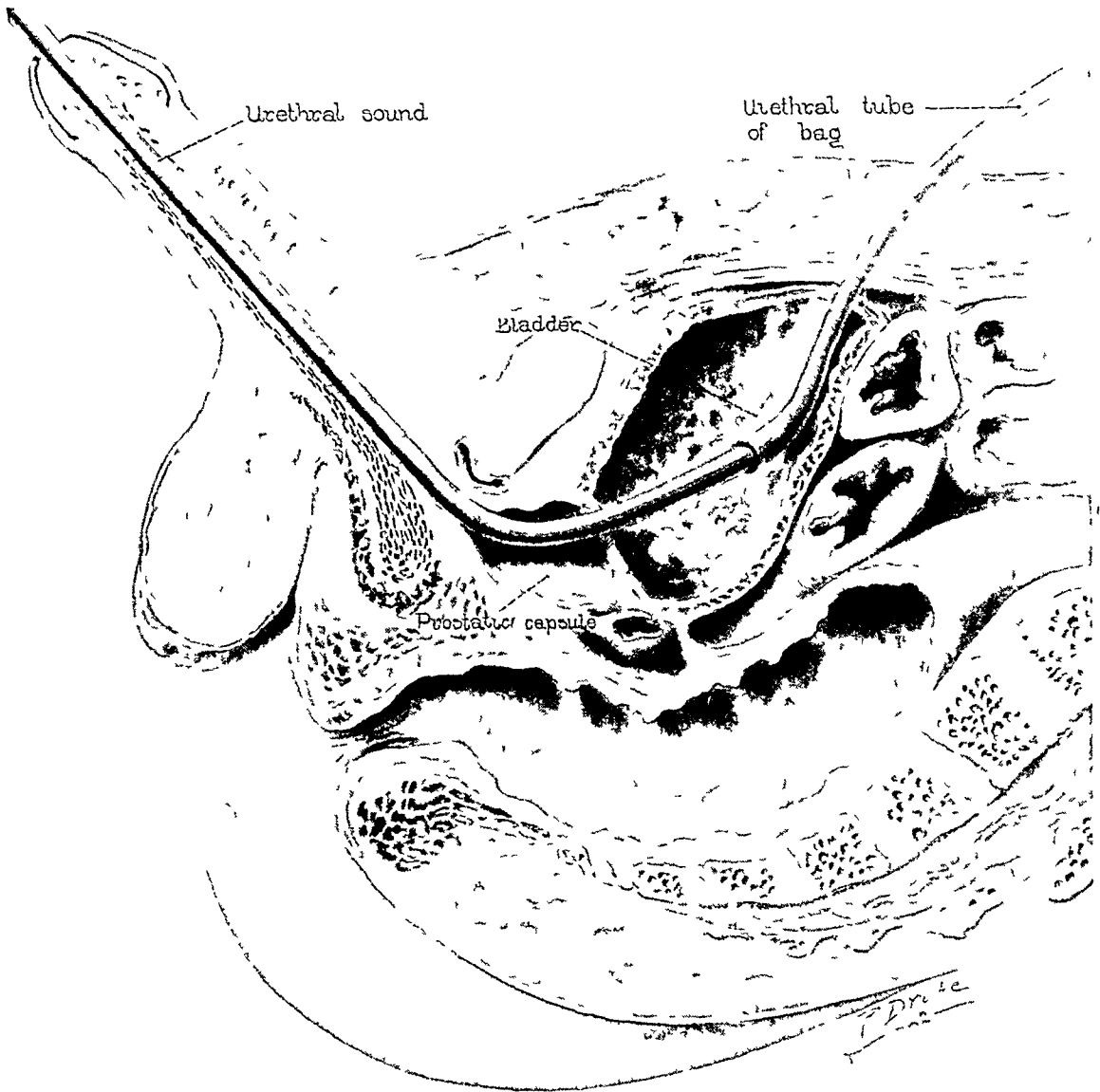


FIG 7 —Sagittal section after enucleation of the prostate showing method of introducing bag

and delays the establishment of urethral urinary drainage It is necessary for urinary drainage only so long as the bag is in place Considerable difference of opinion exists regarding the length of time the bag is required In most instances six hours is probably long enough, and little reason may be presented for prolonging the time beyond twelve hours However, on my own service it has been more convenient not to release the water from the bag and relieve traction under sixteen hours after operation The bag is allowed to remain deflated for a few hours and careful observations for bleeding are

continued for several hours. In about 4 per cent of cases reinflation of the bag is necessary, in the remainder the suprapubic tube and bag are all removed within twenty-four hours after operation. Preceding the removal of the bag, a No. 16 male catheter is attached to the urethral tube of the bag and drawn into the bladder as the bag is withdrawn suprapubically. Providing hæmostasis has been accurate, continued suprapubic drainage serves no purpose, and urethral drainage of the bladder, after removal of the bag, obviates suprapubic urinary drainage and favors early healing of the wound.

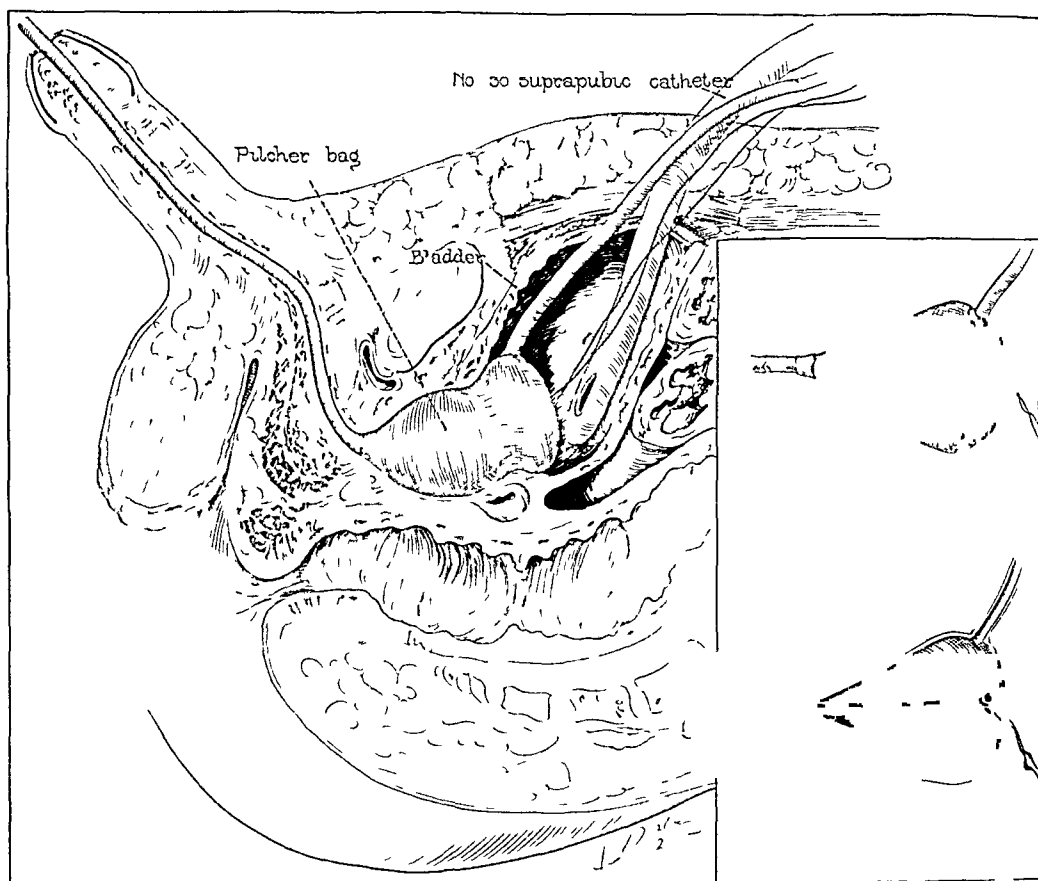


FIG 8—Sagittal section with Pilcher bag distended impinging on vesical neck. Insert shows construction of bag and means of providing traction on base of bag by silk strand threaded through the urethral tube.

The urethral catheter is maintained for from twelve to fourteen days after which voluntary urethral urination is in most cases restored without suprapubic leakage.

Results of the Use of the Pilcher Bag—From January 1, 1921, to December 1, 1925, suprapubic prostatectomy has been performed in 1020 cases at the Mayo Clinic. The Pilcher bag was used in 702 cases and iodoform gauze packs with or without thromboplastic substances, chiefly kephalin, in the remainder. A careful review has been made of the post-operative course of these patients, it has been possible to make some comparison between cases in which the bag was used and those in which other methods of hæmostasis were employed.

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According to my experience the Pilcher bag accomplishes complete hæmostasis, as evidenced in most instances by clear urine at all times after operation and the persistence of clear urine after removal of the bag within twenty-four hours, except in about 4 per cent of cases, in which temporary reinflation was necessary. A gauze pack, on the other hand, while usually quite adequate for controlling bleeding, allows a variable amount of blood to ooze into the urine for several days, and often after the pack has occupied the prostatic capsule for several days its removal precipitates bleeding of different amounts, at times to the extent of severe hæmorrhage. The bag, in its deflation, simply drops away from the prostatic capsule and has no tendency to precipitate bleeding. Secondary hæmorrhage, after the bag had been used, occurred from the fifth to the ninth day in but seven cases, one of which was after partial prostatectomy for carcinoma.

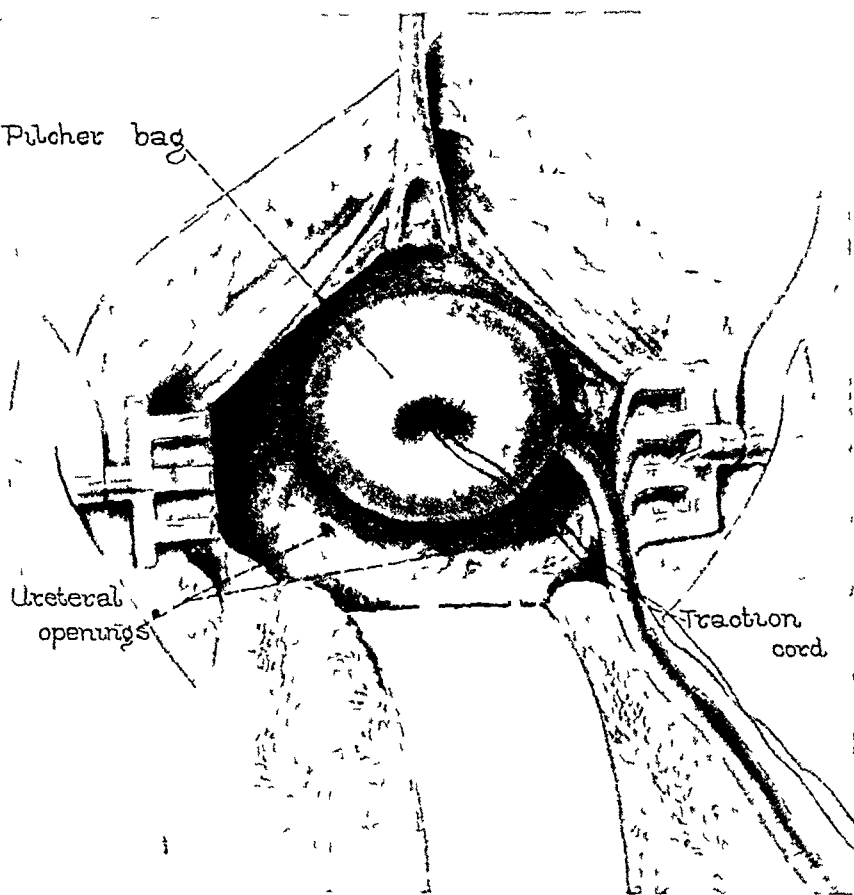


FIG 9—Suprapubic view of bag inflated and impinging on vesical neck

As a result of the early removal of the suprapubic drain, with early institution of drainage of the bladder by urethral catheter, made possible by the Pilcher method of hæmostasis, 75 per cent of the wounds healed without suprapubic urinary drainage and they healed earlier. In those cases in which the Pilcher bag was used and the suprapubic tube removed early, healing of the wound occurred on the average in but three-fourths the time required when gauze was used to control bleeding and suprapubic drainage was prolonged.

The physical and organic reserve of the patient with prostatic obstruction should be improved by preliminary treatment to insure safety in operating. As Bugbee has stated, removal of the prostate is but an incident. However, it is a most important incident and requires for its successful accomplishment visible procedure when possible and accurate hæmostasis. In my experience

the Pilcher bag offers a most effective method of accurate hæmostasis after suprapubic prostatectomy

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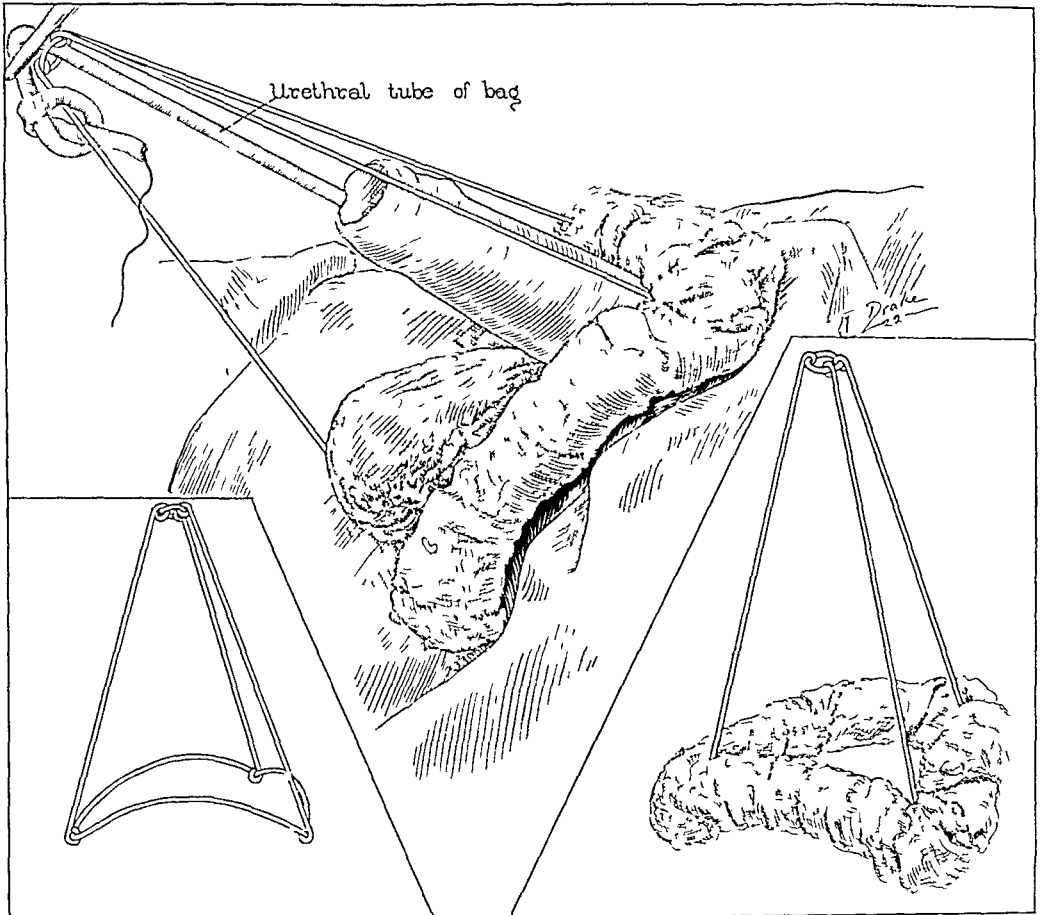


FIG 10 —Method of maintaining traction over Hamer's perineal tripod No traction is exerted on the elastic tube of the bag but upon the silk strand threaded through the urethral tube

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ARTHROTOMY FOR KNEE-JOINT CALCULI*

By JOHN J. MOORHEAD, M.D.

OF NEW YORK, N. Y.

THE surgical knee has always been a problem to the surgeon, and no other joint has received so much attention or been subject to more controversy from a diagnostic and therapeutic standpoint. The ordinary injuries such as

synovitis, patella and articular fractures, foreign bodies and the septic knee—all of these, common as they are, are not standardized as to treatment, perhaps excepting patella fractures. The controversy as to mobilization *versus* immobilization in reality centres about the knee, and this despite a war and post-war experience of much magnitude.

If these common injuries are still the subject of wide differences of opinion among competent surgeons, it is not surprising that the diagnosis and treatment of intra-articular loose bodies is still more controversial. The problem is one of the oldest in joint surgery, and we are told that Ambrose Pare successfully removed a loose body from the knee in 1558, and Annaudale in 1877 sutured a meniscus. Hey in 1784 used the term "internal derangement of the knee" and since then the surgical literature of England, France, Germany, Italy abounding refers to this topic, the invading bodies being denominated by a variety of terms such as "loose bodies," "ice bodies," "joint mice," "joint concretions," and others more or less descriptive.

In our own country, until recently at least, intra-articular invasion of this sort has received rather scant attention, sur-

prising in view of the writings of Sir Robert Jones and Rutherford Morrison, who have probably removed more such invaders from the knee than have been reported by all the surgeons in America. This suggests that if English

* Read before the New York Surgical Society November 25, 1925. From the Department of Traumatic Surgery, New York Post-Graduate Medical School and Hospital.

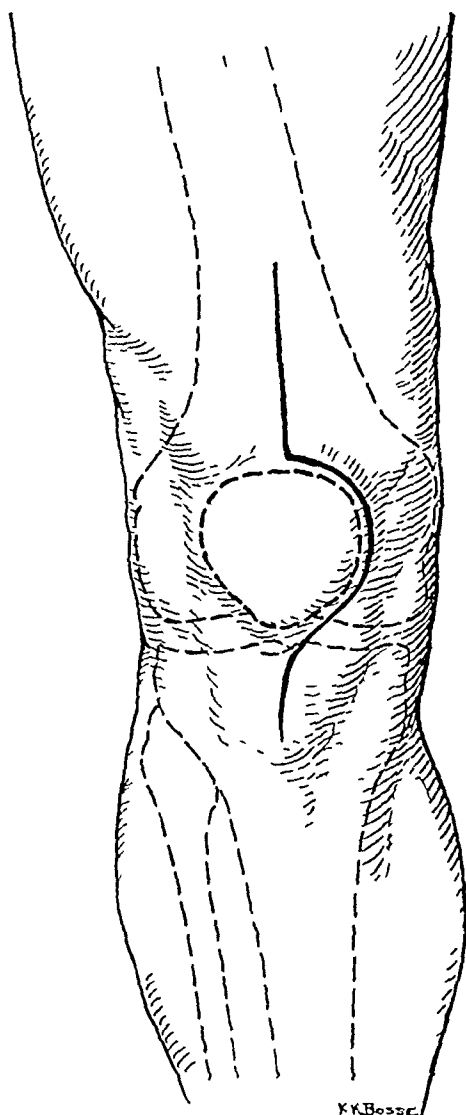


FIG. 1.—Medio lateral arthrotomy skin incision

ARTHROTOMY FOR KNEE-JOINT CALCULI

and some continental surgeons call thrombo-angitis-obliterans "the American disease," we might aptly call knee meniscus disturbance "the English disease"

Without any preliminary statements as to the anatomy of the knee-joint, it is the object of the writer to record his observations on forty-nine cases in which arthrotomy was performed to remove arthroliths which had been the

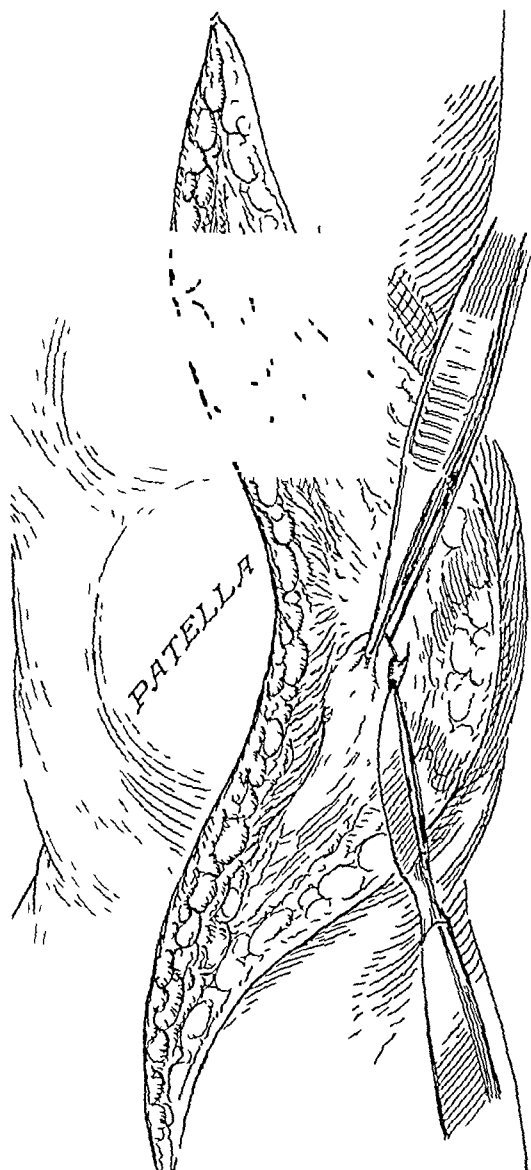


FIG 2 —Incising capsule at lower end of wound

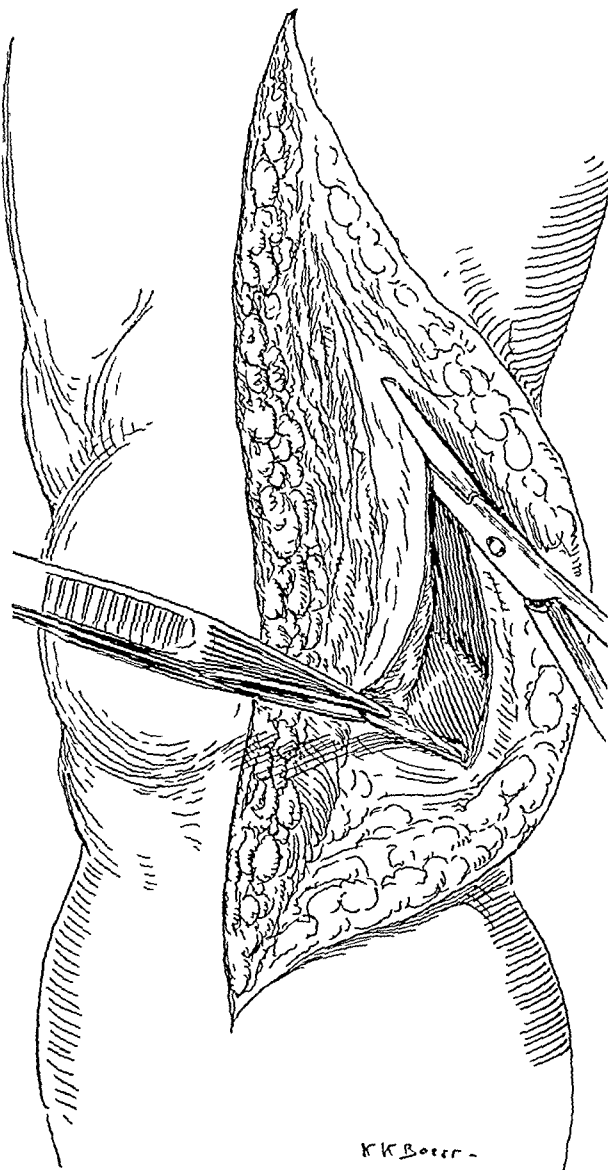


FIG 3 —Capsule being incised along line of skin incision

source of knee dysfunction extending, in many cases, over a period of several years

From a clinical standpoint this review readily assembles itself into three groups of cases, namely, the *acute*, *subacute* (or recurrent) and *chronic*

Acute Group—In these the onset is usually sudden and in most cases is ascribed to indirect trauma, such as twisting violence, as is best represented by a football player tackled and thrown while running, or sustaining the injury in a scrimmage. Tennis, hockey, baseball, skiing, golf, skating and other similar activities furnish additional members of this group, variously termed "football knee" or "athlete's knee." Certain occupations apparently

are prone to this condition, and indeed in England it is known as the "Miner's knee," for it occurs often when the patient is at work with the knee more or less bent, violence then twisting or rotating the joint, as in an effort to straighten up from a crouching position. Much has been written as to the exact mechanism by which the joint invades becomes

detached and the majority of writers assert that version or rotation of the thigh is a prerequisite. However, others of equal experience assert that version or rotation of the tibia is the essential element.

It seems fruitless to debate these factors at length, for in the end we would not reach any firmer agreement than now obtains, for example, as to the mechanism by which Colles' fracture occurs.

This acute group is best represented by relatively young people, and most of them are between sixteen and twenty-five years of age.

The usual history is that while walking, working or playing a sudden wrench of the knee took place, and this was immediately followed by pain, swelling, and more or less disability. The patient often falls and in some cases contact with the ground is more accused than the preliminary twist or wrench. The joint is found to be partly bent in a number of cases, and at all events in some of them a cer-

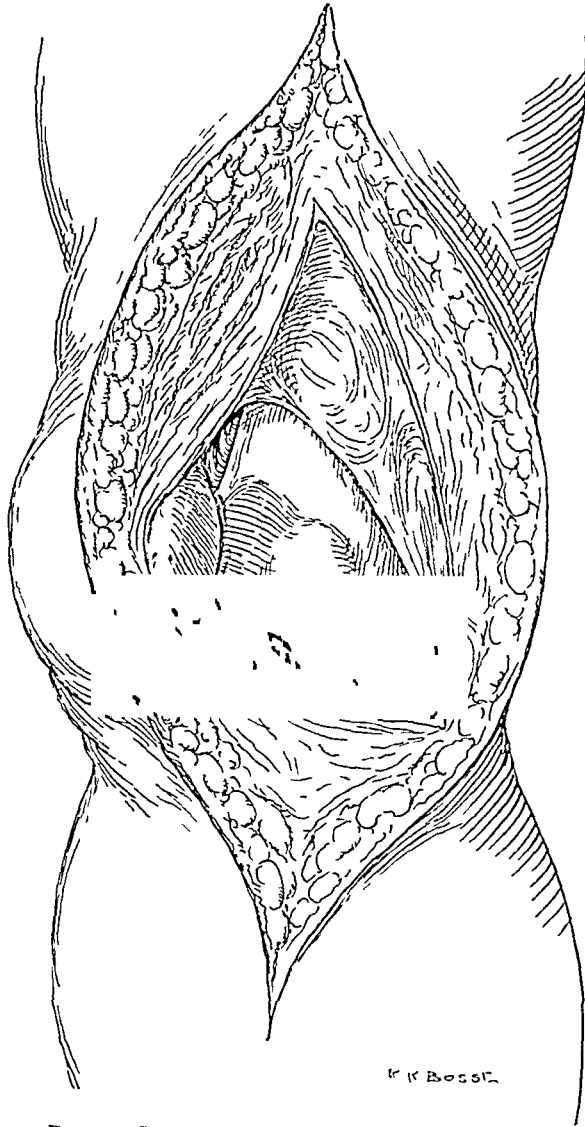


FIG. 4—Patella retracted showing antero-lateral portion of joint

tain amount of manipulation is required before it can be straightened. If it occurs in football, massage and adhesive tape may permit continuance of the game, but in such instances and in all others, joint swelling promptly appears. This may be localized and assume the appearance of a bursitis or limited synovitis, but in the majority the outstanding features, next to pain are synovitis and limitation of function. As a matter of fact most of these patients are regarded by the profession and laity alike as suffering from "water on the knee."

ARTHRITIS FOR KNEE-JOINT CALCULI

If such effusion has occurred, the exact diagnosis may be masked or missed unless localized tenderness can be elicited, or a calculus can be palpated, or, more rarely, X-ray examination discloses the actual traumatology. If the effusion is promptly aspirated, as it should be, pressure over the head of the tibia with the knee flexed, may elicit tenderness over the inner or outer meniscus, and this may be corroborated by obtaining pain in the same location by rotating the tibia, inasmuch as the cartilages move with this bone (Fig 11). Incidentally it is pertinent to say that the effusion of acute traumatic synovitis is practically always sero-saneous, and I have known it to remain so as long as six weeks after the initiating trauma.

X-ray examination is usually not helpful, even if made after injecting the joint with oxygen or other gases (Fig 14). We tried this procedure many times, and sometimes felt that obscure cases were better evaluated thereby, however, we have abandoned this diagnostic aid, instead relying upon the history and the findings, of which more will be stated later.

Many variations as to the extent of symptoms obviously occur, and all grades are encountered from minor pain, joint limitation and effusion to extreme manifestations with ensuing disability. Many persons have had single attacks of this sort without any recurrence whatever, but the rule is that one attack predisposes to another, and thus they pass into the subacute or recurrent group. It is my belief that the initial injury often fractures a meniscus or partly detaches it, and that a second injury actually separates or dislocates it.

If this latter ensues, blocking of the joint may occur, giving rise to the so-called "locking of the joint," which is so characteristic of semi-lunar



FIG 5 —Knee hyperflexed with patella retracted, exposing semi-lunars and crucials

injury but which may occur with other forms of calculi, but usually to a lesser extent

The analogy between knee-joint traumatology and abdominal pathology

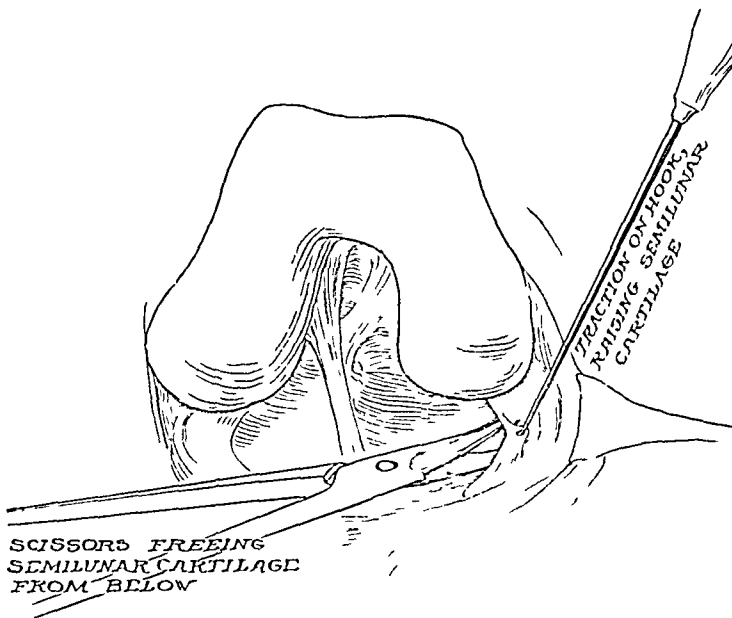


FIG. 6 —Beginning excision of internal semi-lunar

tempts a surgeon to parallel the lesions common to these respective cavities. The term "calculus" which is herein used was employed because of their symptomatic resemblance to gall-bladder kidney ureter and urinary bladder "loose bodies" or calculi. In the abdomen these may remain wholly quiescent or silent,

and at times they may become activated by a variety of more or less well authenticated causes

By analogy, these bodies in the knee may remain silently quiescent unless aroused into activity by trauma or a distant infection. The so-called indigestion due to gall-stones may well be likened to the similar conditions occurring in the knee, and either cavity under adequate provocation is subject to attacks of colic. The analogy is helpful and suggestive if further, we regard this process in the knee as demanding surgery rather than physiotherapy braces or antirheumatics

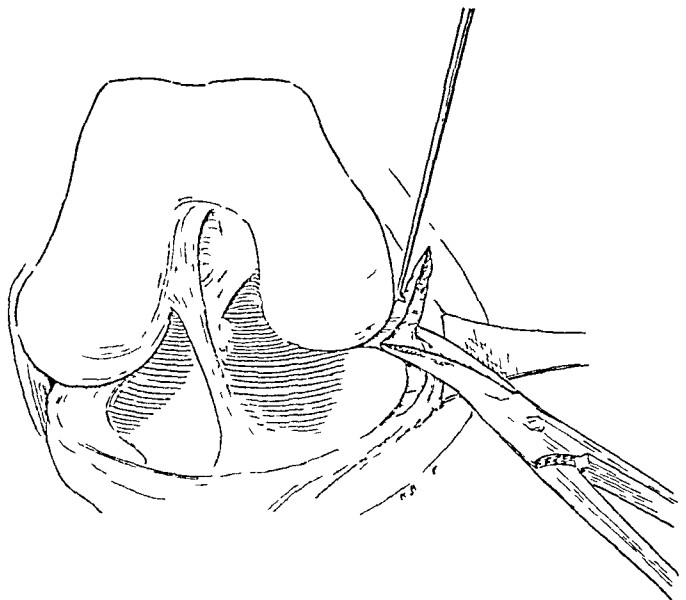


FIG. 7 —Excising posterior attachment of internal semi lunar

Subacute and Recurrent Group—These are the cases in which prior attacks of joint disability have occurred, either as the direct result of repeated trauma, or by metastasis from a distant focus. Some of these patients have

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had many attacks of "joint colic" the knee has been uncertain for months, perhaps it has required some sort of knee-cap, mesh bandage or other support when called upon to perform any unusual act. These are the cases of so-called "recurrent synovitis," or "mono-articular arthritis," or "articular neuritis" or "weak knee." They all give a history of a distant initial seizure, a quiescent interval period, and then a recurrence ascribed to some definite or indefinite factor. Each succeeding outbreak of temporary pain, synovitis and

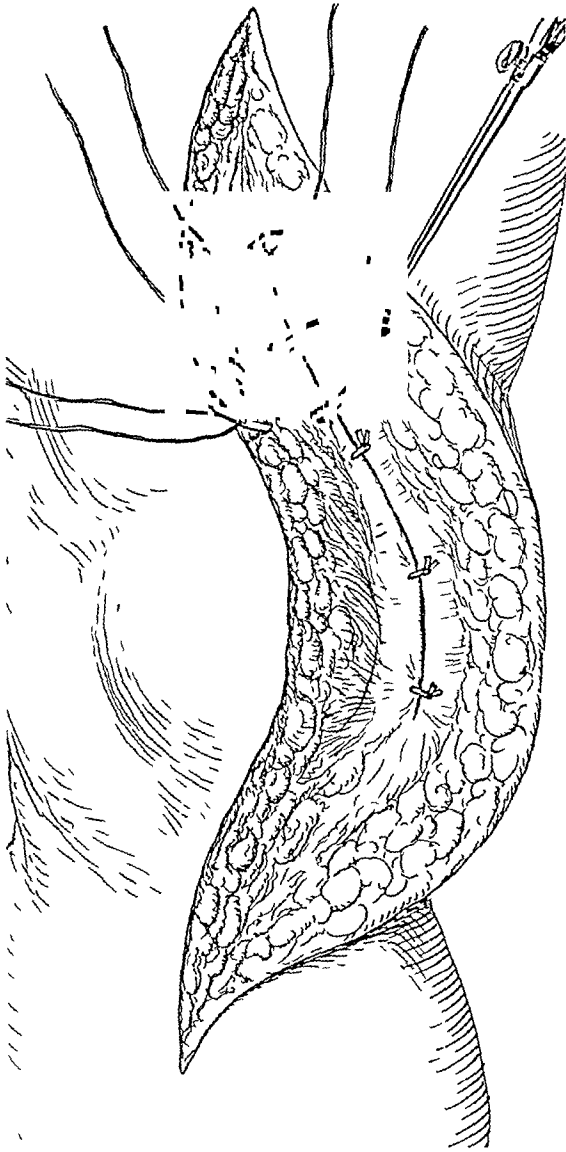


FIG 8 —Capsule sutured. Deep fascia and part of vastus internus being sutured

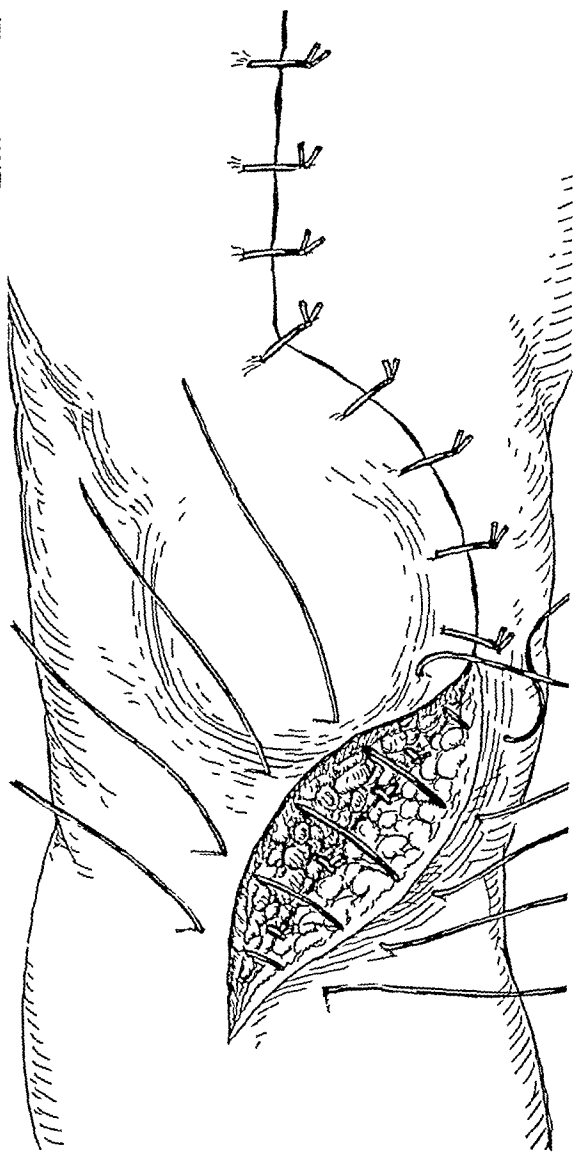


FIG 9 —Skin and superficial fascia being sutured

joint limitation may mimic in all respects the preceding attacks, and here again cholelithiasis and nephrolithiasis are by analogy called to mind.

Examination in this group, in addition to the cardinal triad of signs (pain, swelling and limitation), will show atrophy of the quadriceps group and, usually, a laxity of the knee-joint capsule amounting sometimes to actual insecurity or instability. Such a patient will often volunteer some such statement as "I am not sure of my knee," or "My knee lets me down," or "My knee goes out on me." Local pain is often present, crepitus exists, the

calculus may be seen or felt, or both, the X-ray examination will show peri-arthritis, perhaps visualize the calculus, perhaps show signs of osteo-arthritis or villous synovitis

This group of patients is older in years, upwards of twenty-five, and certainly older in articular experience. Invasion of the joint by the products of inflammation or distant infection are superadded to the articular trauma, and some of them indeed give no history whatever of violence adequate to the

pathology. These, then, are a mixed group as to etiology, in that they may be (1) wholly traumatic, (2) traumatic and inflammatory, (3) inflammatory, (4) disease processes.

Chronic Group—If inflammatory or due to infection, these are examples of arthritis registering as a mono-arthritis of the knee, or, as is more usual affecting this joint more than others. If due to disease, we accuse syphilis, tuberculosis, osteochondritis sicca, osteochondritis dessicans. Some neuropathy, or factors unknown or undetermined, may enter into the picture. At all events the destructive process is advanced enough to make the damaged knee an object and subject of



FIG 10—Incisions for median arthroscopy, medio-lateral arthroscopy, lateral arthroscopy

comment, for it is obviously distorted, it creaks, it does not move fully, the adjacent muscles are wasted, calculi are often visible or palpable, and X-ray examination shows more or less gross deformation with probably visible arthroliths.

These, then, are the usual clinical classifications, and they might with equal facility be called *primary*, *intermediate* and *late* groups, but whatever their allotment, they all present a relatively constant surgical pathology.

Surgical Pathology—The *acute* or *primary* group usually shows

1. Fracture or fracture-dislocation of a meniscus. The internal semilunar is involved in by far the greater proportion.

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2 Sprain-fracture or chip fracture of the contiguous femur, tibia or patella The very rare cases of fractured tibial spine and ruptured crucial ligaments are in this category also

3 Subpatella fat pads are hypertrophied or fused into a mass known as lipoma alboscens

4 Villous synovitis

5 Bands, adhesions, cysts

The Subacute (Recurrent) or Intermediate Group

1, 2, 3, 4, 5 of the preceding

6 Synovial excrescences not unlike adenoids in appearance

7 Exostoses or enchondiomata

The Chronic or Late Group

1, 2, 3, 4, 5, 6, 7 of the preceding

8 Hypertrophic osteo-arthritis

9 Joint irregularities

Treatment—Acute or Primary Group—If the joint is bent or locked, it should be straightened by manipulation, with or without anæsthesia There are two procedures, the one advised by Sir Robert Jones being satisfactory in the majority of cases, and in this the knee is bent, and abducted fully, and when thus manipulated, the surgeon places his finger over the meniscus and directs the patient to forcibly kick the knee straight, or the surgeon himself quickly forces it straight The other method is to forcibly bend, abduct and drag down the knee, and while thus in traction suddenly extend the limb If after repeated vain trials of either or both methods, it is needful to give an anæsthetic and then by flexion, rotation and extension force the invader into position Relief of pain and return of extension are the signs of successful reduction

Joint effusion should then be removed by aspiration The joint is thereafter placed on a light posterior splint and a wet dressing is applied Massage and external heat are used daily, and when pain on pressure subsides, and when banging on the heel causes no acute tenderness, the patient is allowed to walk, a light posterior splint being worn to prevent flexion Passive motion begins when rather active massage causes no continued reaction, and soon thereafter guarded active motion is allowed If football or other games are regarded as essentials by these patients, then suitable guards are to be used Overbending or rotation of the unsupported knee should be proscribed for several months

The Subacute (Recurrent) or Intermediate Group—Here the process eventuates into a synovitis, usually localized, and treatment is either by (a) aspiration, followed by immediate mobilization, or (b) rest with pressure immobilization on a posterior splint Many of these patients habitually wear some form of knee support, usually a mesh or semielastic knee-cap, and in these quadriceps atrophy is a feature, and hence this group benefits from massage and radiant heat, both of which stimulate the weakened muscles and promote absorption of the joint exudate

The Chronic Group—Actual deformation of joint structures is usually present, so that treatment aims to preserve the musculature and absorb joint effusion. Physiotherapy is the best treatment for the local condition, and in this group especially it is needful to carefully investigate any possible source of distant infection, such as the oral and adjacent cavities, the appendix, the gall-bladder and the urogenitive system.

Operative Indications—Very rarely will the surgeon be called upon to operate for an initial attack, and, hence, arthiotomy becomes the chosen method only when the process has recurred often enough to make the joint unsafe for ordinary pursuits. Recurrent attacks of pain, effusion and joint



FIG. 11—Eliciting local tenderness on palpation internal semi-lunar regions

limitations eventuate into muscular atrophy and more or less joint deformity, any combination of these justifies surgical relief. Cartilage in the knee, as elsewhere, rarely heals smoothly, for example, the "cauliflower ear," the nasal septum.

The Operation—Arthiotomy may be said to be *limited* when performed through a small exposure, as for the removal of a meniscus or a localized arthrolith or exostosis. Arthiotomy may be said to be *general* when performed through a large exposure, as for the removal of hypertrophied fat pads, multiple arthroliths, multiple exostoses, villous synovitis, or damage to the tibial spine, crucial ligaments, or for chip fractures of the intra-articular bony prominences (Fig 10).

Here, again, the analogy between laparotomy and arthiotomy is sug-

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gestive, and indeed the joint surgeon, like the abdominal surgeon, more and more prefers wide incision to limited incision, except when the indications are clinically and classically localized. In acute cases definitely appendicular, a relatively small incision still suffices, but in subacute and chronic cases the prudent surgeon explores not only the lower but also the upper abdomen. The parallel holds precisely for the knee cavity, and here the appendix of the joint may well be said to be the internal meniscus.

Semilunar Excision—A vertical approach is satisfactory and is customary, although many surgeons incise in a crescentic manner, and others prefer a U-shaped approach. Whatever the type of incision, it is essential that the knee be placed at a right angle, so that the supratibial joint space is as wide as possible. This is accomplished by hanging the legs over the end of the table after the plan suggested by Jones. This requires a seated position on the part of the operator, and it also means that the operating table has to be elevated before suturing in three layers is begun. To obviate these features, sometimes embarrassing if redraping the field is required, we now place the patient supine and fully bend the knee to be operated upon, resting the foot against the opposite thigh, the latter braced by a sandbag (Fig 12).



FIG 12 —Obtaining right-angled flexion by placing foot against opposite thigh obviating hanging leg over end of table

We believe that we can thus better visualize our field, and feel also that we are less likely to disturb the draping of the parts. The matter of employing the ultra-aseptic hands-off or Lane technic is a matter for individual judgment, but in our cases of arthrotomy we have rigorously followed this method from the beginning of the preparation for the operation until the gauze dressings are placed. The suture nurse handles all the material with sponge holders, and the sutures are previously cut six inches long and threaded through a large rubber tube, so that one by one they may be withdrawn by the second assistant. Each instrument before being re-used is thrown into a basin of very hot saline, and this solution is changed every fifteen minutes during the course of the opera-

tion All instruments are passed to the operator and his assistant by clamps, and all sutures are inserted by a Reverdin needle-holder, and are tied by clamps No tourniquet is used Perfect hæmostasis is aimed at and is usually obtained by suturing the separate layers without resort to ligature

It is almost impossible to remove the entire cartilage, except when it is much frayed, or of the two-piece or so-called "bucket handle" type The anterolateral portion is the part usually involved, and this is excised in one or two segments A narrow-bladed knife is essential, and rotation of the knee will often bring into view a hidden or posterolateral segment Normally, the

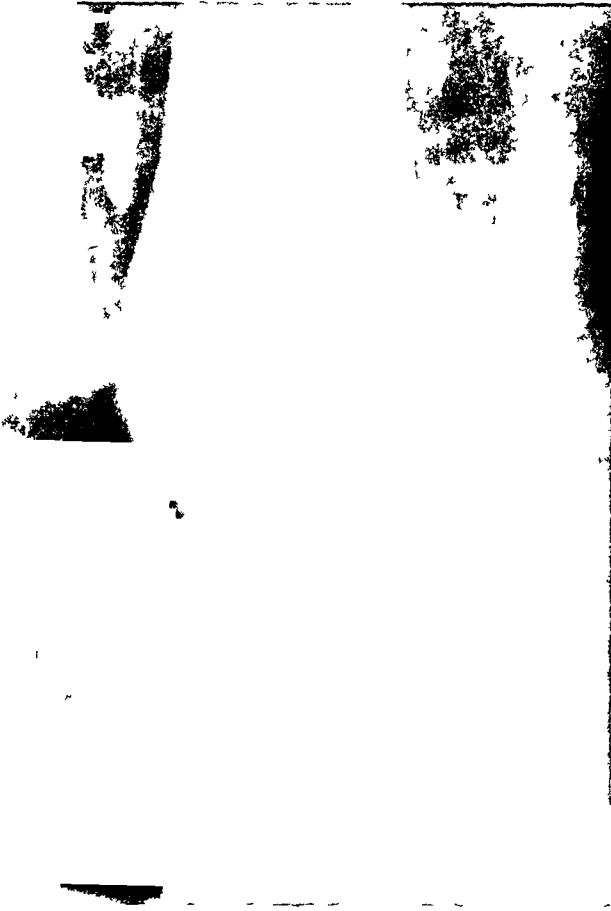


FIG 13 —Knee-joint calculus

cartilage is about as thick as a dollar, but in advanced cases it may be as thin as a dime In a number of our cases the pathologist found little, if any, cartilage, and almost total replacement by fibrous tissue We place a wet dressing of 100m saline solution (100m one dram to normal saline one pint) over the wound, and cover this by dry gauze a layer of cotton, and then bandage in such a position that right-angled motion is possible No splintage has been used We insist on immediate motion every two hours, to and from a right angle twice, this to begin when the patient is out of the anæsthetic This is most painful during the first

two days, but thereafter is usually relatively painless In patients who decline to cooperate, we permit the use of a pillow which is gradually forced higher and higher under the knee, and gradually lowered therefrom after the desired height is obtained In others, we pass a sling under the knee and attach a cord thereto, and this passes to a pulley in an overhead frame, so that raising and lowering of the joint is thereby obtained We insist that shuffling or contraction of the quadriceps begin at once, so that there is early return of ability to lift the heel off the bed with the knee straight We do not aspirate for post-operative effusion, and indeed this does not long persist if early motion is accomplished On the

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third or fourth day the patient bends the knee over the side of the bed, and on the fifth, sixth or seventh day he is permitted to walk. Stitches are removed on the seventh day. No knee-cap is worn. Electric light or sunlight exposure is used after the fifth day if joint swelling or tenderness appear to be unusual. We regard this form of after-treatment as essential, and believe that the first two post-operative days are the most important, in that motion then attained is retained, so that post-operative trauma will not result in a grade of stiffness that may require weeks of physiotherapy before it is overcome.

Intra-articular Approach, Exploratory Arthrotomy—For the subacute (recurrent) and chronic groups, a limited or low arthrotomy often will not suffice because the marginal and superior portions of the joint are frequently coincidentally affected. The analogy suggested is that of acute appendicitis or acute cholecystitis in which a limited or regional exposure is satisfactory, but in recurrent or long-standing intra-abdominal affections prudence dictates the more radical exploratory laparotomy.

Four procedures are in vogue for this purpose:

- 1 *Bilateral incision* at either margin of the patella
- 2 *U-shaped incision* with division of the patella tendon

We have not used either of these, and do not regard them as advisable or needful.

3 *The patella-split or median arthrotomy*, known variously as the Olier incision (*arthrotomie trans-rotulienne*), or the Jones incision (*vertical trans-patella*). In this the skin incision begins above the summit of the middle of the patella, and passes straight downward to end at the tibial tubercle (Fig 10). The patella is sawed completely, or it is sawed partly, and then split by a chisel. If now the bisected patella is retracted, adequate joint

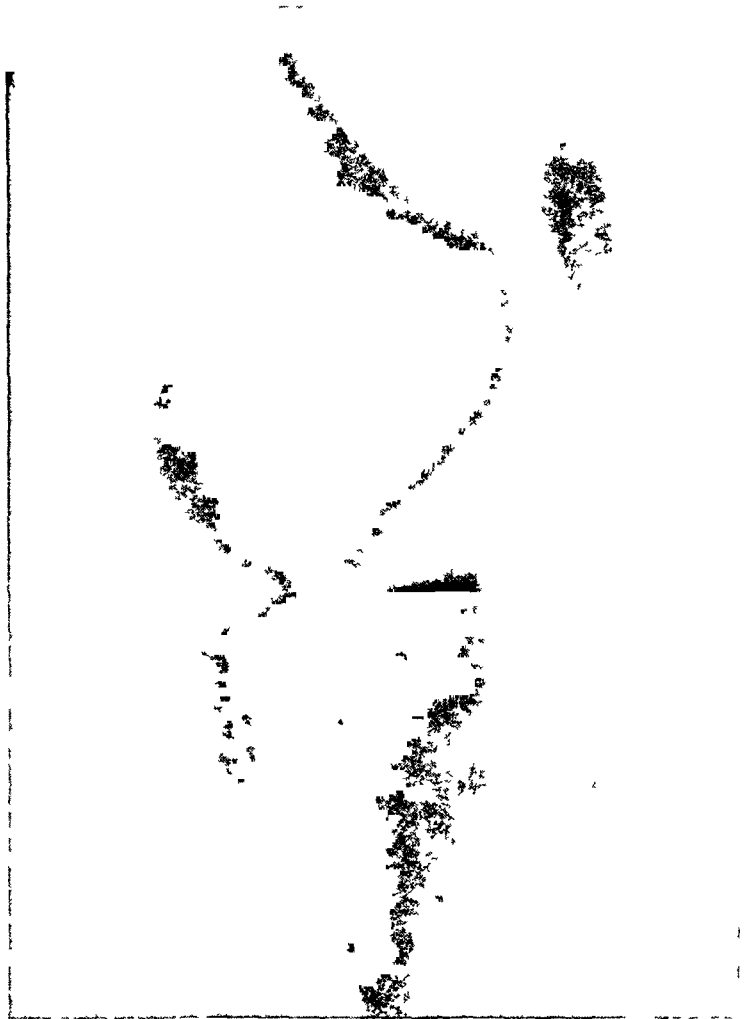


FIG 14 —Air injected joint showing dislocated semi-lunar

TABLE I

List of Cases—(M = Median—L = Lateral—ML = Medio lateral)

No	Name	Age Sex	Cause	Arth- rotomy	Findings	Operation	Days		Remarks
							In bed	In hosp	
1	L D' A	67 F	Gradual onset	M	Calculi, arthro-synovitis	2-9-19			Bilateral process osteo-arthritis
2	V B	M	Injury	M	Calculi, hypertr synovitis	2-2-20			
3	H M	34 F	Fell on stairs	M	Fract int semi-lunar, villous synovitis	2-28-20	7	11	Arthritis in other joints
4	B V M	44 M	Kicked by horse	M	Fract int semi-lunar, arthro-synovitis	5-15-20	5	15	Policeman—original injury 12 years prior to operation
5	A S	19 M	Wrenched knee	L	Dislocated int semi-lunar	3-8-21	3	6	
6	M G	20 M	Wrenched knee	M	Dislocated int semi-lunar	6-16-21	3	8	
7	L M	26 M	Wrenched knee	M	Dislocated int semi-lunar, arthroliths	6-23-21	3	6	
8	M M	22 F	Jumping from tree	M	Fractured int semi-lunar, villous synovitis	12-2-21	3	16	Prior operation Wore brace for years Limb much atrophied Knee excessively mobile Intra-articular reeving of capsule
9	M W	24 F	Fell skating	M	Fracture-dislocation int semi-lunar, villous synovitis	2-2-22	4	8	Hospital nurse Resumed duties Knee excellent, Oct, 1925
10	D H	27 F	Dancing	M	Int semi-lunar fractured, hypert synovitis	2-27-22			
11	M F	51 F	Gradual onset	M	Villous synovitis, arthroliths	3-20-22	8	41	Arthritis in other joints Referred to medical consultant for colitis
12	N D	34 F	Fell	M	Fractured int semi-lunar, villous synovitis, bony arthrolith	4-4-22	7	9	General health poor Knee in excellent condition Oct, 1925

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I3	W M	23 M	Wrenched knee	M	Fracture-dislocation int semi-lunar	4-12-22	4	6
I4	E B	32 M	Infection No trauma	M	Calculi, arthro-synovitis	4-20-22	4	19
I5	J S	23 M	Wrenched knee	M	Fracture-dislocation int semi-lunar, villous synovitis	5-1-22	6	8
I6	D C	23 M	Infection wrenched knee	M	Arthroliths, villous synovitis	5-5-22	3	8
I7	G H	24 M	Basket ball	M	Dislocated int semi-lunar, villous synovitis, membranous bands	6-8-22	6	22
I8	E E	25 F	Blow on knee	M	Villous synovitis, hypert fat pads Membranous bands	6-9-22	6	8
I9	E O	26 M	War injury, fell	L	Fracture int semi-lunar	6-10-22	3	8
20	F H	29 M	War injury, fell	M	Dislocated int semi-lunar	9-19-22	4	16
21	E A	28 M	Russian dancing	M	Dislocated int semi-lunar	9-26-22	3	11
22	H B	26 F	Gradual onset	M	Hypert synovitis	12-20-22	7	11
23	C J	23 M	?	L	Int semi-lunar fractured	1-22-23		
24	F S	59 M	Fell, infection	M	Dislocated int semi-lunar, hypert osteo-arthritis	5-8-23	6	14
25	B K	23 M	Wrenched knee	M	Dislocated int semi-lunar	6-29-23	3	13
26	R S	25 M	Fall	M	Int semi-lunar fractured, hypert fat pads	7-2-23	6	12

TABLE I —Continued
List of Cases—(M = Median—L = Lateral—ML = Medio-lateral)

No	Name	Age Sex	Cause	Arth- rotomy	Findings	Operation	Days		Remarks
							In bed	In hosp	
27	L M	26 F	Wrenched knee	M L	Fractured int semi-lunar	10-1-23	8	11	First case medio-lateral incision Post-operative temperature for 48 hours No wound in- fection Knee excel, Oct, 1925
28	L S	24 M	Wrenched knee	L	Int semi-lunar fractured	10-27-23	7	9	
29	I D	40 F	Wrenched knee	M L	Dislocated int semi-lunar	11-8-23	4	9	Excellent result, June, 1925
30	LeG S	18 M	Football	M L	Fractured int semi-lunar ac synovitis	12-3-23	4	18	Preliminary aspiration Post- operative synovitis Playing football, Oct, 1925 Wears knee pad
31	J B	42 M	Gradual onset	M L	Fractured int semi-lunar, hypert fat pads	1-14-24	4	12	Combination injury-infection
32	G H B	38 M	Wrenched knee	M L	Fractured int semi-lunar	2-21-24		12	
33	E K	39 M	Struck knee?	M L	Fracture int semi-lunar, hypert fat pads and synovitis	3-20-24	4	19	Combination injury-infection Broke needle during opera- tion Still has pain and limited motion, June, 1925
34	J R	65 F	Gradual onset	M L	Calculi, Hypert synovitis	3-24-24 3-21-24	4 5	19	Both knees Died 12 days after second operation Embolism? Myocarditis? Walking when fatal seizure occurred
35	K R	29 M	Playing base- ball	M L	Dislocated ext semi-lunar, hypert fat pads	5-19-24	7	15	Acute traumatic synovitis 8 mos post-operative Aspirated
36	G O	48 M	Wrenched knee	M L	Fracture int semi-lunar, hypert fat pads	10-2-24	4	13	

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37	H C M	20 M	Basketball	L	Int semi-lunar dislocated	11-10-24	5	9	Returned 11-4-25 with synovitis due to recent injury Knee active since operation
38	H W	9 M	Baseball	M L	Int semi-lunar dislocated, hypert synovitis	12-26-24	6	12	Previous aspiration 12-4-24 No tuberculosis Knee excellent, Nov, 1925
39	W S P	24 M	Football	L	Fracture int semi-lunar	1-5-25	4	16	Repeated attacks of locking College hockey star Knee excellent, May, 1925
40	M H	27 M	Wrenched knee	M L	Calculus hypert synovitis	2-9-25	7	15	Still complains of pain and limitation, June, 1925
41	P F	24 M	Football	L	Fracture int semi-lunar	2-12-25		10	Reports knee excellent, Oct, 1925 Rugby football player
42	E L B	50 F	Wrenched knee	M L	Dislocated int semi-lunar, hypert synovitis	2-16-25	5	11	Still complains of pain and limitation Arthritis present in other joints
43	J M	37 M	Blow, wrenched knee	L	Int semi-lunar fracture-dislocation	3-20-25	5	11	Ex-British soldier Soccer player Prior injuries Still has occasional pain Knee active
44	J S	38 F	Gradual onset	M L	Hypert synovitis	5-21-25	4	10	
45	H L F	20 M		L	Fracture-dislocation int semi-lunar	12-21-24	4	9	College athlete Knee excellent, Sept, 1925
46	W A F	30 M	Wrenched knee	L	Int semi-lunar fracture-dislocation	4-16-25	4	8	Repeated attacks of knee locking Knee excellent
47	C W	39 M	Wrenched knee	L	Fracture-dislocation int semi-lunar	6-12-25	5	8	Repeated attacks of locking Arthritis in other joints
48	S S T	21 M	Football	L	Fracture-dislocation int semi-lunar	9-21-25	5	9	Excel function, Nov 10, 1925
49	G J S	39 M	Gradual onset	M L	Int semi-lunar fracture-dislocation Fat pads hypert	11-9-25	5	7	

exposure is attained, especially if the joint is flexed. In villous synovitis especially, this procedure is very valuable, and if need be, complete synovectomy can be accomplished. In passing it is interesting and important to know that Key has recently shown † that in rabbits, after complete synovectomy, there is a replacement of the synovial lining in sixty days.

Closure is made in three layers, the innermost coapting the capsule, the next the deep fascia and the last the skin and subcutaneous tissues. The patella is automatically coapted by these two deeper layers, and requires no drilling or other procedure to accurately and firmly unite it. We have not used a tourniquet and have not varied the after-treatment, insisting on the



FIG 15—Hypertrophic osteoarthritis

same immediate mobilization as in the already-described arthrotomy for meniscus calculi. The only modification is ether lavage, which we employ for more adequate hæmostasis and because debris is floated out through a sterile medium which evaporates. All suturing is of the interrupted variety, plain catgut for the deeper layers and silk-worm gut for the external layer. In our series of forty-nine cases we have used this incision twenty-three times.

4 *The medio-lateral incision* in which the incision begins above the top of the middle of the patella and then passes to within one-

half inch of the knee-pan, and thence passes around half of the latter close to its edge, and thence downward to end at the tibial tubercle. Usually, the lateral half of the incision passes to the inner side of the patella inasmuch as the internal meniscus is often associated with the pathology higher up (Figs 1 to 10). Some of the fibres of the vastus internus are cut, and to that extent this incision is faulty, but this defect is balanced, in that the patella is not split. The exposure is adequate, it involves soft parts only, it is more speedily made. Closure is as in the preceding, and the after-treatment is identical.

† Journal Bone and Joint Surgery, vol vii, No 4, October, 1925

ARTHROTOMY FOR KNEE-JOINT CALCULI

We have performed this operation in fourteen cases, and it has superseded the patella split approach with us since October, 1923

These, then, are the usual procedures, and for completeness may be added the posterolateral or posteromedian incisions when the rear compartments of the joint are affected. We have not encountered this class of case

End-results—After removal of a cartilage, a fat pad or section of villous synovia, is the joint capable of resuming function? Our experience thus far is that the operative relief equals that afforded by comparative procedures in other closed cavities, notably the abdomen. Aside from this we have had recent occasion to check up the football and other squads at certain colleges, and the local surgeons, coaches and trainers are of the opinion that athletics, even of the most radical sort, can be resumed and are resumed by many who have had knee-joint arthrotomies. The failures appear to be in the subacute and chronic cases, and here, as expected, the pathology was too diffuse to be remedied by the mere removal of a foreign body.

All of these patients could not be traced, but we have records of a sufficient number to indicate that relief from symptoms has been very gratifying. There has been no post-operative joint stiffness in any of the group, and so far as is known, joint stability and flexibility has been improved. The outstanding features of this compilation may be said to be the recognition that arthrotomy is a reliable procedure for calculus mono-arthritis, and that general arthrotomy does not contra-indicate speedy return of function.

Number of cases, 49, males, 36, females, 13, oldest, 67, youngest, 9. Lateral arthrotomy, 12, median arthrotomy, 23, medio-lateral arthrotomy, 14



FIG. 16—Comminuted fracture head of tibia with bony calculus in joint

CONCLUSIONS

1 The surgical knee is a type of mono-arthritis initiated by trauma, but often activated or aggravated by distant infection

2 The internal meniscus is more often involved than any of the other structures, next commonest findings are hypertrophied fat pads, villous excrescences, and bone fragments

3 The cardinal signs are pain, synovitis, joint limitation, to these are often added atrophy, joint instability and crepitus

4 X-ray examination is of positive value only when the arthroliths are calcified

5 The history and examination usually present a fairly typical picture, so that the patients fall into three groups (acute, subacute and chronic) as to age in years and age in pathology

6 Arthrotomy, limited or general, is notably effective in a selected group of patients

7 After-treatment by active mobilization is an important feature

8 The ultra-aseptic (Lane) technic has given primary union in this series of forty-nine cases

9 Arthrotomy does not contraindicate future joint activity, even in athletes, if the articulation has not been too greatly damaged prior to operation

10 Accumulating experience indicates that *general* arthrotomy is a wiser procedure than *limited* arthrotomy, and hence this latter type of approach should be reserved for early cases, or those in which the diagnosis is relatively certain

11 The length of incision is no bar to immediate active mobilization, and with any form of approach, the patient can with safety and profit be encouraged to walk within the first week

12 The analogy between intra-abdominal lesions and intra-articular knee lesions is very striking as to symptoms and treatment

13 Recurrent synovitis is usually more due to intrinsic than extrinsic causes, and relief therefrom is more certain by surgery than by physiotherapy, apparatus or drugs

PRIMARY PNEUMOCOCCUS PERITONITIS

BY RICHARD A. LEONARDO, M.D.

OF ROCHESTER, N. Y.

FROM THE SURGICAL SERVICE, ROCHESTER GENERAL HOSPITAL

SOME three years ago a series of experimental and clinical data was published, tending to show that primary pneumococcus peritonitis is strictly limited to young girls, and that the source and mode of infection is *via* the external genitalia and Fallopian tubes ¹ Several articles have appeared in the literature since that time, supporting this conclusion ²

In December, 1925, A. H. Montgomery ³ reported a case of primary pneumococcus peritonitis occurring in a male infant, age eight weeks, thus showing that the idiopathic form of this disease is not limited to girls, and that the mode and source of infection may be hæmatogenous or through the intestinal tract, as well as *via* the female genitalia

I wish to report three recent cases of primary pneumococcus peritonitis, which coincide with Montgomery's findings, inasmuch as in none of them was infection *via* the genitalia possible. These cases are all in adults, one, a woman whose uterus had been amputated some fifteen years ago, and two males. My opinion is that all three cases are primary—though one may possibly question whether Case I is primary or not, since râles were present in the right lung at the time the peritonitis was diagnosed.

CASE I—Mr. T. S. Age sixty-four years. Admitted September 13, 1924, on account of knife-like pains in his upper abdomen (epigastrium). He had had a hard sore (?chancre) on his penis ten years ago, which disappeared one month later without treatment. For the past few years has had "attacks of indigestion" with discomfort after meals. This "discomfort" (not acute pain) was not relieved by food or alkali, nor did it come at any definite time interval following his meals. His present illness began suddenly September 13, at 1:30 A.M. (six hours before admission), with sharp pains across lower abdomen. The pains were not colicky and not relieved by change in position. Abdomen became very hard. Vomited three times. Bowels moved slightly day before. No diarrhœa.

He was an elderly male, evidently acutely ill. Markedly emaciated. Cheeks sunken—typical hippocratic facies. His *abdomen* was distended and board-like with no *localized* tenderness or rigidity. *Temperature* 97.3 rectally. *Pulse* 100—good quality. *Respiration* 20.

Laboratory findings. White blood-cells, 6000 September 15, 7300 September 16,

RICHARD A LEONARDO

10,400 September 19 Polymorphonuclears 75 per cent each time *Urmalysis* negative, except for alkaline reaction and 1+ albumen *Wassermann* negative to both antigens

The abdomen was opened by Dr E W Phillips Right rectus incision Free fluid in abdomen Peritoneum injected Some hemorrhagic areas along gut No evident perforation Pancreas felt normal Wall of appendix injected Appendectomy No drainage

Culture from peritoneum (time of operation) *Pneumococcus*

Progress notes September 14—comfortable Abdomen less rigid, especially on left side

September 17—wound clean Condition good Somewhat disturbed by frequent hiccoughing

September 19—Abdominal condition not good Moderate distention Nauseated Vomited last night and again this morning

September 20—A M—Condition poor Coughing Bloody sputum Loud râles in right chest To be X-rayed and sputum typed

September 20—P M—Stomach washed out Some mucus, very little blood, no greenish material Later, stomach washed again—fluid returned clear To go to operating room for drainage of thoracic duct

September 20—P M—Three-inch incision parallel with lower posterior border of left sternomastoid muscle Thoracic duct exposed, ligated and incised below the ligature Yellow serous fluid escaped Wound partially packed No sutures Orders continue as before

September 21—A M—Condition not improved Labored respirations Given 1300 cc normal salt solution intravenously

September 21—P M—Condition worse Definite pneumonia of right middle lobe Temperature vacillated between 99 and 101 Terminal rise to 104 Pulse 100 to 120 Respirations 20 to 28 Died

The pathological report on the appendix showed

Mucosa—Edema and glandular catarrh Round cell and eosinophile infiltration Little lymphoid tissue

Sub-mucosa—Thickened Infiltration with many round cells, eosinophiles, and polymorphonuclear leucocytes

Muscularis—Polymorphonuclear infiltration

Serosa—Covered with organizing exudate Polymorphonuclear infiltration and hemorrhages

CASE II—Mr C L Age fifty-seven Admitted May 8, 1925, at 940 P M, complaining of severe generalized abdominal pain He had always enjoyed fairly good health No serious infectious diseases nor major accidents His present attack began at 4 P M, May 7, 1925 While helping to carry a large heavy box of merchandise, his companion suddenly let go, so that the other end of the box struck the patient's abdomen, crushing it severely Patient complained at once of abdominal pain and later vomited Seen at 9 P M (next day) in consultation and sent to hospital He was a well-nourished adult apparently in acute pain, with anxious facial expression His abdomen was very tender throughout, generalized "protective spasm", no marked distention Temperature, 98.6 Pulse, 140 Respiration, 36

The abdomen was opened by Dr O E Jones Several loops of small intestine pre-

PRIMARY PNEUMOCOCCUS PERITONITIS

sented, inflamed and agglutinated with plastic lymph. No evidence of obstruction. The primary cause of the peritonitis was not found. Culture of peritoneal fluid taken. Two rubber drainage tubes inserted and wound closed.

The culture from the peritoneum gave pneumococcus.

Post-operative course. Temperature rapidly mounted to 105°. No rally after operation, but failed rapidly. Patient died at 10 10 A M., May 9.

At autopsy the whole peritoneal surface was found reddened, congested and covered with fibrino-purulent exudate with more liquid pus in the dependent parts of pelvis and flanks. Exudate not bloody. No odor, no admixture of faeces or gastric contents.

The intestines were gas dilated and with serosal congestion. No rupture of intestines or of other abdominal viscus. No area of contusion or hemorrhage showing through peritoneal inflammation. Section of spleen normal. Liver and kidneys show slight cloudy swelling only. Gall-bladder normal. No duodenal or gastric ulcer. Appendix involved in general peritonitis, inflammation seems limited to surface.

No excess fluid in pleural or pericardial cavities. Rather slight hypostatic congestion at lung bases. Heart essentially negative.

Bacteriological note. Smears from abdominal pus show numerous pneumococci, no other organisms. Culture from autopsy (peritoneal exudate) pneumococci.

CASE III—Mrs. R. Age forty-six. Admitted October 3, 1925, on account of nausea, vomiting, pain and tenderness in lower abdomen particularly on the right.

Always healthy as a girl. Neisser infection at twenty-six, from which she says she did not recover until operated upon five years later—supra-vaginal hysterectomy and appendectomy. No gastro-intestinal, genito-urinary or cardio-respiratory disturbances. Her present illness began September 27 (one week before admission), when she had a sudden, rather severe pain in whole upper abdomen of a dull throbbing character, accompanied by nausea and vomiting. Abdomen at this time was not tender. She was quite ill that day, but the next day seemed somewhat better. Pain remained as a dull ache but seemed to settle slowly to the lower abdomen. She could keep nothing on her stomach, however, and had vomiting spells two or three times a day. She said she felt fairly well and had no vomiting spells the day before admission but at night the pain became rather severe again in the lower abdomen. Next morning pain was worse and she began vomiting. She continued to get worse and entered the hospital that night.

She was a well-developed, well-nourished adult female of forty-six, acutely ill and in rather marked pain. Some dyspnoea but no cyanosis. Her abdomen was rigid and board-like below umbilicus, tenderness marked over both right and left lower quadrants, no masses. Vaginal examination, tenderness elicited in both fornices, cervix stump present, uterus missing. Temperature 103. Pulse, 88. Respiration, 28.

Laboratory findings. White blood-cells, 7500. Polymorphonuclears, 76 per cent. Lymphocytes, 24 per cent. Urine negative, except for a few white blood-cells in sediment.

At operation, about one hour after admission, free fluid was found in the peritoneal cavity, of sero-purulent type. Intestines were congested and coated with fibrinous exudate. Appendix not present. Gall-bladder normal. Enterostomy done on left.

Smear showed pneumococci, culture showed pneumococci.

Post-operative course. Temperature remained around 102, blood culture on three different occasions showed no growth. Patient looked surprisingly well and said she felt quite well. Abdomen changed to a doughy hardness, no distention. Taking large quan-

tities of fluid—as much as 80 ounces in a day White blood-cells which at time of operation was 7500, three days post-operative rose to 35,000 with about 90 per cent polymorphonuclears Has remained at this level Four days after operation right side of the abdomen and the right flank around to back was seen to be red Hot magnesium sulphate packs applied for five days, when process seemed localized and there was fluctuation in the right side Incised under local and a large amount of foul pus expressed—culture showed pneumococci Patient at this time looked rather poorly Temperature, 103 Patient somewhat irrational at times

Progress notes, October 13 Back and side much better Temperature dropped from 103 to 99.4 Patient looking and acting better White blood-cells, 23,500

October 14 Patient complains of diplopia Back still somewhat red Induration and redness almost completely gone from abdomen and side Definite general improvement Incision in right side, and abdomen draining pus profusely Bowels moving without enemata Though patient is still very sick, she has shown some improvement in last few days Urine 2+ albumen, rare white blood-cells, on culture and direct smear, Gram-positive bacilli Wassermann, negative

October 16 Condition unimproved Temperature septic in type Less induration in back Suggestion of fluctuation on both sides of spine

October 17 Definite abscess formation, especially on right side of back Incised under local anaesthesia About six ounces of pus exuded

October 19 Pulse poor Patient very toxic All incisions are necrotic-looking Profuse drainage Sutures removed from abdominal incision which is widely gaping Large mass of necrotic fascia removed and then wound was strapped with adhesive Coil of small intestine forms floor of the abdominal incision

October 20 General condition continues poor Patient not taking food Appears and acts as though overwhelmed by toxæmia Temperature about 102 Fæcal fistula developing White blood-cells, 11,300

October 22 Grew progressively worse and died Autopsy refused

Discussion—From a study of the above cases, it is obvious that primary pneumococcus peritonitis is *not* solely limited to young girls nor even to the female sex We are supported in this contention not only by the case reported by Montgomery (*vide supra*) but by at least five additional authentic cases in the literature

1 Two cases of primary pneumococcus peritonitis in male nurslings, ages six months and ten weeks, respectively, reported by Ribadeau-Dumas et Meyer ⁴

2 One case of primary pneumococcus peritonitis in a male infant, age five weeks, reported by G. L. Hallez ⁵ (This infant was partially bottle-fed because the mother developed an abscess of the breast—hence, infection *via* the intestinal tract cannot be ruled out)

3 One case of primary pneumococcus peritonitis in a boy, age sixteen, reported by Paiseau et Duchon ⁶

4 A case of primary pneumococcus peritonitis occurring in a woman at

the eighth month of gestation⁷ (In the words of Bruce M Dick, the author, "it is difficult in such a case with a pregnant state of the uterus to conceive of a spread of infection from the lower genital tract taking place")

The rôle of trauma in the causation of pneumococcus peritonitis, as exemplified by Case II of our series, has seldom been considered. Hence we call attention to the interesting experiments by Peiser,⁸ in which he demonstrates that the serous membranes, particularly the peritoneum, so long as they are uninjured, are impermeable to bacteria circulating in the blood stream. Invasion through *intact* peritoneum takes place only in the moribund stage of a severe septic process. Peiser found, however, that in cases where the peritoneum had been subjected to even the slightest degree of trauma (intra-peritoneal saline solution suffices), bacteria will enter the peritoneum from the blood stream very quickly. Depending on the virulence of the bacteria and the resistance of the individual, peritonitis may or may not result.

No specific serum therapy was attempted in our cases. The literature reveals (1-9) that of a total number of 22 cases that were typed, 16 were Type I, 3 Type II and 3 Type IV. Of 6 Type I cases treated by specific serum therapy, only 2 are reported to have been benefited.

CONCLUSIONS

1. The source and mode of infection of pneumococcus peritonitis in the so-called primary or idiopathic cases is not solely *via* the genital organs in young girls nor is this disease limited to the female sex.

2. Trauma is an occasional etiological factor.

I wish to thank the members of the surgical staff for their kindness in permitting me to report these cases.

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TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY

Stated Meeting Held November 11, 1925

The Vice-President, DR FRANK S MATHEWS, in the Chair

CARCINOMA OF TONGUE

DR GEORGE H SELMKEN presented a man, aged forty-seven years, who first came under observation, May 22, 1918. Six or eight years previously a pin-head sized, white spot had appeared on the left side of the tongue, and this had grown slowly but progressively. There had been no treatment of the growth prior to two months previously, when radium treatment (by surface application) had been begun. No benefit resulted from the use of radium, but instead, a moderate degree of leukokeratosis had been added. There was no history of a known antecedent case of cancer, the previous history was negative. There was no demonstrable syphilis. The Wassermann test was negative, and the only discoverable etiologic factor was the excessive smoking of strong cigars, which were usually held in the same position (one place). Examination showed a pearly-white, mushroom-shaped papilloma on the left border and dorsum of the tongue. The lesion was excised under local anæsthesia, June 17, 1918. Histologic examination (by Dr Francis C Wood) showed it to be a papilloma, with one small area of "breaking through,"—an early epithelioma.

Although the incision had been wide and relatively deep, early in October, 1919, a new lesion appeared on the under surface of the left half of the tip of the tongue—an elevated ulcer 0.4 cm in diameter, with indurated edges which proved to be a frank squamous-celled epithelioma.

In cases of cancer of the tongue, the cancer field consists of the lesion and the related lymphatics. It has been shown by Kuttner (*Beitr z klin chin*, 1898, vol xxi) that the lymphatic apparatus of the tongue is very rich in anastomoses, and that it is possible to inject the lymphatics of both sides of the neck from a single puncture in any part of the tongue. The chief nodes related to the tongue lie in the carotid packet of the deep chain, in the region of junction of the lingual and common facial veins (or their combined trunk) with the internal jugular vein. Other lymphatic vessels lead to the submaxillary group of lymph-nodes, and still others lead directly to a lower group of the deep chain, at the crossing of the omohyoid muscle over the internal jugular vein, without passing through the upper groups of this chain—notably, two lymphatic vessels from the region of the tip. Kuttner did not find any lymphatic vessels leading from the tongue to the submental packet of lymph-nodes, but such vessels were later demonstrated by Jamieson and Dobson (*British Journal of Surgery*, 1922, vol viii), who verified the other findings of Kuttner. These observations have been borne out also, by clinical experience with cases of cancer of the tongue, the cancer metastases following the same channels as the injected dye solution (suspension). It has been accepted, therefore that the lymphatic removal in cases of unilateral cancer of the tongue if completely done, must include the complete lymphatic dissection of the side of the neck corresponding to the side

of the lesion, together with the submental lymphatics, and the submaxillary and deep chain of the opposite side of the neck, down to the omohyoid crossing

The extent of excision of the tongue, in unilateral cases anterior to the vallate papillæ, is a little more than one-half. In order to avoid a sharp tongue tip, the tip of the healthy side is removed. In order to include the small lymph-nodes in the middle line of the tongue, the longitudinal line of incision is carried along the uninvaded half of the tongue, adjacent to the midline, and in order to include as many lymphatic trunk vessels as possible, the incision is made to curve further on the healthy side, posteriorly, to sweep around the freely decussating vessels at the apex of the vallate papillæ, and it is carried about the lower pole of the adjacent tonsil, where the main dorsal lymphatic vessels dip down into the neck. The tonsil is sometimes included in the removed tissue mass. In order to insure a complete excision without crossing the cancer field, it has been found desirable to place a series of black silk suture guides, with ends left long, at landmark points on the tongue. It is difficult to recognize anatomical landmarks in the mouth if there is any bleeding, but this difficulty is overcome when the suture guides are used, and the incision is kept outside of these, always in the healthy tissue. As a precaution against implanting cancer cells upon fresh wound surfaces, the surface of the lesion is well cauterized with the actual cautery before the excision of the tongue segment is begun. The intra-oral operation, without jaw splitting, is done in all cases in which there is no involvement of the floor of the mouth or of the posterior region of the tongue.

An operation of this extent requires its division into two stages, and it is the present practice, following the suggestion of Butlin and others to include the tongue operation in the first stage, to prevent any further dissemination of cancer from the primary focus during the interval. Technically, this is a disadvantage because a preliminary ligation of the lingual artery of the affected side together with the division of the hypoglossal nerve and the lingual branch of the fifth nerve, is followed by a very considerable retrogression in the lingual tumor, and makes the tongue operation less difficult. Also, it has been found undesirable to dissect the side of the neck corresponding to that of the lesion at the same operation as that upon the tongue, because of the likelihood of infection of the neck wound *via* the cut lymphatic vessels from the mouth. The plan adopted, therefore, has been the dissection of the opposite side of the neck and the removal of the tongue segment at the first operation, and the block dissection of the related side of the neck after a suitable interval, not less than ten days preferably two or three weeks. A temporary control of the external carotid by untied ligature angulation is helpful in controlling the bleeding during the first part of the intra-oral operation. In the case under consideration, however, the order of these stages was reversed. November 15, 1919, at the Skin and Cancer Hospital, under colonic ether anæsthesia, a complete block dissection of the lymphatic of the left side of the neck was done. The removed tissue included the submental and submaxillary groups, the superficial chain, the deep chain from the jugular fossa to the clavicle, and the supraclavicular node group. The lingual artery was tied, and the hypoglossal and lingual nerves were divided. November 25, 1919, the operation on the lymphatics of the right side was done, the submaxillary group, the superficial chain, and the deep chain from the jugular fossa to the omohyoid cross being included in the excision, and the left half of the tongue together with part of the right half of the tip and the tissue at the lower pole of the left tonsil, was removed. Recovery was uneventful, the patient left the hospital December 10, 1919, and has had

CARCINOMA OF ANTERIOR FLOOR OF MOUTH

no subsequent difficulty His speech is good, and he has been able to continue his work with the New York Fire Department The histological examination of the removed lymphatic tissue showed no metastases in the sections examined

CARCINOMA OF ANTERIOR FLOOR OF MOUTH—SEDILLOT OPERATION

DR GEORGE H SEMKEN presented a man, aged forty-six years, who came under observation, November 22, 1920 Six months previously, he had noticed a lesion in the anterior part of the floor of the mouth, but sought no advice until a few days before his admission to the New York Skin and Cancer Hospital There were no known antecedent cases of cancer in the family and the only discoverable possible etiologic factor was the free smoking of a corn-cob pipe, which however, had been discontinued about two years previously Examination showed a slightly elevated lesion of the low papillary type, in the anterior part of the floor of the mouth, about the orifices of the submaxillary salivary ducts, approximately 2.0 cm in diameter, but irregular in extent, deep red in color, and slightly indurated There were no palpable lymph-nodes in the neck The Wassermann examination was negative

The operation was done in two stages, with an interval of ten days, and in reverse order to the present practice in cancer cases—namely, the removal of the lymphatics was done at the first stage, and the lesion was removed in the second November 30, 1920, a bilateral dissection of the upper cervical lymphatics was done, in one block The submental group, both submaxillary groups, the superficial chains and each of the deep chains of nodes from the jugular fossa to the level of the omohyoid crossing, were removed The dissection included the outer segment of the sheath of the internal jugular vein, and in the deep chain groups were included the nodes posterior to the internal jugular vein, over the scaleni and levator anguli scapulae muscles An uneventful healing followed December 10, 1920, the Sedillot operation (later elaborated by Kochei) was carried out The lower lip was divided in the midline, and this incision was continued in the midline of the neck, to the level of the hyoid bone The anterior surface of the symphysis of the mandible was exposed with the raspatory and four small drill holes were made in a straight line along the long axis of the bone, two on each side of the midline of the jaw The bone division was made from the drill holes in the middle, leading upward from one and downward from the other, and they were joined by a small transverse chisel cut at right angle to the line of bone section, thus making the bone cut slightly terraced in shape The muscle attachments (anterior belly of digastric, mylohyoid, and geniohyoid) were divided for a short distance, the cut bone ends were strongly retracted, and the lesion in the floor of the mouth was excised The excised tissue included a wide margin of healthy mucous membrane, the submaxillary salivary ducts, the remnants of the submaxillary salivary glands, the sublingual salivary glands, and part of the anterior muscular floor of the mouth The raw surface was lightly cauterized to destroy possible cancer implants and to form a temporary barrier against infection The bone was united with a chromic catgut suture passed through the outer drill hole of each side, and the divided lip and neck regions were carefully sutured At the conclusion of the operation, a dental fixation splint was placed over the lower teeth to insure proper alignment in the jaw The soft tissues healed at once, but sequestra separated from the mandible until about three months later There has been no return of the growth, the present appearance is good, and there is no disturbance of function in the mouth or the jaw The report of the histological

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The operation was done in two stages, with an interval of ten days, and in reverse order to the present practice in cancer cases—namely, the removal of the lymphatics was done at the first stage, and the lesion was removed in the second November 30, 1920, a bilateral dissection of the upper cervical lymphatics was done, in one block The submental group, both submaxillary groups, the superficial chains and each of the deep chains of nodes from the jugular fossa to the level of the omohyoid crossing, were removed The dissection included the outer segment of the sheath of the internal jugular vein, and in the deep chain groups were included the nodes posterior to the internal jugular vein, over the scaleni and levator anguli scapulae muscles An uneventful healing followed December 10, 1920, the Sedillot operation (later elaborated by Kocher) was carried out The lower lip was divided in the midline, and this incision was continued in the midline of the neck, to the level of the hyoid bone The anterior surface of the symphysis of the mandible was exposed with the raspatorv and four small drill holes were made in a straight line along the long axis of the bone, two on each side of the midline of the jaw The bone division was made from the drill holes in the middle, leading upward from one and downward from the other, and they were joined by a small transverse chisel cut at right angle to the line of bone section, thus making the bone cut slightly terraced in shape The muscle attachments (anterior belly of digastric, mylohyoid, and geniohyoid), were divided for a short distance, the cut bone ends were strongly retracted, and the lesion in the floor of the mouth was excised The excised tissue included a wide margin of healthy mucous membrane, the submaxillary salivary ducts, the remnants of the submaxillary salivary glands, the sublingual salivary glands, and part of the anterior muscular floor of the mouth The raw surface was lightly cauterized to destroy possible cancer implants and to form a temporary barrier against infection The bone was united with a chromic catgut suture passed through the outer drill hole of each side, and the divided lip and neck regions were carefully sutured At the conclusion of the operation, a dental fixation splint was placed over the lower teeth to insure proper alignment in the jaw The soft tissues healed at once, but sequestra separated from the mandible until about three months later There has been no return of the growth, the present appearance is good, and there is no disturbance of function in the mouth or the jaw The report of the histological

examination of the tissue removed showed squamous-celled carcinoma in the lesion and no metastases in the node sections examined

DOCTOR SEMKEN added that every case of cancer in the mouth and tongue, except some of those of the upper jaw, is squamous-celled in type, and is a potential metastasizing tumor. The report of negative findings in the histologic examination of the regional lymph-nodes may be misleading, for it can apply only to the few sections examined, and other fields containing cancer may be overlooked. This was clearly shown by Gussenbauer many years ago (*Monatschu für Heilkunde*, vol 11, 1881), and it has been substantiated by the experience of recurrences in lymphatic areas beyond the limits of excision in cases where the excised nodes showed no cancer in the sections examined. If surgical operations for cancer are to save life, the procedures must be extensive and complete, irrespective of the small size and brief duration of the lesion, and the absence of palpable regional lymph-nodes.

HEMIGLOSSECTOMY FOR TONGUE CANCER

DR WINIFIELD SCOTT SCHLEY presented a man on whom he had performed this operation six years ago, for extensive carcinoma of the whole right anterior two-thirds of the tongue and dorsum to the midline and with glands in the neck. Two other similar cases, alive and well after four years and twelve years respectively, he had expected to present as well, but they were prevented from appearing by temporary illness.

When first seen, the patient presented seemed in such bad condition that operation hardly appeared feasible, but after oral antiseptics there was sufficient improvement to appear to warrant operation. Extensive block dissection of the neck, upon the side involved only, followed by hemiglossectomy was done.

As Doctor Schley has stated and written before, the results in such cases as in all cases of cancer, were directly proportionate to the care exercised and upon the extent of the first operation, as one might not have a second opportunity, and recurrences were usually much more difficult to deal with. These cases as in others he had reported, showed what could often be done with apparently hopeless conditions if they were prepared properly and operated on carefully and extensively.

PLASTIC SURGERY IN CHILDREN COMPRISING BRIDGE FLAPS, PEDICLE FLAPS, TUBED FLAPS, AND EPITHELIAL INLAYS

DRS CARL G BURDICK and FENWICK BEEKMAN presented a series of nine children to illustrate this theme. The first case demonstrated the use of the Fessler Epithelium Inlay as used by Gillies. The child, when sixteen months of age, was burned on the chin and neck. He was seen first in September, 1923, when eight years of age. At that time his chin was drawn down, partly upon his chest, and there was a marked ectropion of the lower lip.

On operating, an incision was made along the entire length of the lower lip just below its vermilion border. The lower flap was well undermined. It was found that the entire thickness of the lip was composed of scar tissue, the muscles having been entirely destroyed. A mould or stent was made of the cavity formed by the undermining, from dental moulding compound. This mould was covered with a large Thiersch graft with its raw surface outward, and the stent, with the overlying graft, was buried in the wound,

the original edges of the incision being again sutured together. Of course, this accentuated the deformity. In five days it was found that the stitches had sloughed and the cavity had opened, the stent was removed, the graft, however, had taken and the wound was represented by a cavity lined with skin, which later flattened out.

Because of lack of musculature in the lip, there was still a tendency for it to sag, so a year later a V-shaped section of the full thickness of the lip was removed just mesial to the right angle of the mouth, thus taking a tuck in the lip.

There is still some tendency for the boy to let his lip sag, but this has been helped by educating him to draw up the corners of his mouth.

The advantage of the "inlay" in this case was an improvement of his deformity by a comparatively simple operation, which if it had failed, would not have interfered with a further plastic operation by means of flaps. "The Esser Inlay" is often useful in contractions of the face in combination with other operations.

The second case demonstrated the use of a tube flap, with epithelium on the inside, in forming a new axilla in a contracture at the shoulder. It is not a new method, but they had found it far superior to sliding flaps, as it makes an excellent apex without any suture line. In the sliding flaps the suture line usually is at the apex and often sloughs.

The child had an old burn about the axilla. When he was admitted to Bellevue Hospital there was a fold of scar tissue measuring about three centimeters thick from the chest at the mid-axillary line to the arm, which limited abduction to about 120 degrees. The first operation consisted of raising a flap two inches wide and four inches long with its base just below the right clavicle and tubing it with the epithelium on the inside. A small incision was made in the skin at the lower edge of the latissimus dorsi muscle and a clamp was passed through the axillary scar coming out at the lower edge of the pectoralis major muscle, anteriorly. The tube flap was then drawn through this tunnel and its skin edges were sutured to those of the skin posteriorly. In time the pedicle of the flap was divided.

At the second operation, a curved incision with its concavity downwards was made between the anterior and posterior openings of the tubed flap and carried on into the tube, dividing it longitudinally. In cutting into the tube, care must be taken that none of the structures of the arm are injured as the anatomy of the part may have been distorted by the contraction of the scar tissue. The upper flap, formed by this incision, was then sutured to the proximal edge of the divided tube and a full thickness graft from the abdomen was sutured in the place between the distal edge of the tubed flap and the skin of the arm. This operation has given this boy a very useful shoulder-joint and well formed axilla.

The third case was one of plastic operation for contraction of the hand following a severe burn in infancy. It illustrates the advantage of a tubed flap over the ordinary bridge flap.

The patient, a girl aged thirteen years, had her right hand severely burned when an infant. On admission to the hospital, the wrist was held flexed at a position of 90 degrees to the forearm and there was a web between the forearm and arm. The little finger was entirely absent, the ring and middle fingers had been removed at the proximal phalangeal joints, the index finger was perfectly normal. The joints of the thumb were entirely ankylosed excepting its carpal-metacarpal joint. It was held bound vertically to the wrist joint by scar tissue, and what represented its distal phalanx was bent

almost at a right angle to its proximal portion. Apparently only the adductor and opponens muscles were present. The patient was unable to approximate the tip of the index finger to the thumb, the hand being practically useless.

The first operation attempted consisted of dividing the scar tissue at the wrist, which was found to extend down to the tendons. When it was divided, the hand could be extended to within 20 degrees of the normal position. The hand was then thrust through a bridge flap on the right thigh and the edges of the flap sutured to the edge of the incision. Following operation, the raw surface of the flap became infected, which caused a good deal of trouble. Finally the pedicles were divided and when the wounds had healed, it was found that the patient was able to approximate her index finger and thumb. However, the wrist was still held in a position of slight flexion, and the transverse carpal arch was very much contracted, the palm having a deep cavity. Soon after a double tube pedicle flap was raised on the left side of the abdomen. When this was healed the lower pedicle was divided and the end closed. Later the scar tissue was dissected from the palm of the hand and the deep cicatricial tissue about the wrist divided, allowing the flattening of the transverse carpal arch and the extension of the hand at the wrist to about ten degrees beyond normal position. The tube flap was then split and sutured into the defect, in due time the remaining pedicle being divided.

The last operation upon this patient was an osteotomy on the bone of the thumb to straighten the deformity at its distal phalanx.

The advantage of a delayed tube flap over a bridge flap when taken from one part of the body to be used on another is that there is so much less danger of infection and the added advantage that the blood supply is so much better established in the former, as the flap has been raised some period of time before attaching it to its new position, while in the latter, the flap has to be sutured in place immediately to prevent infection. Besides this, the resulting scar from where the flap has been removed is apt to be less disfiguring in the case of the tube flap because of lessened chance of infection.

The fourth case was a child who, in 1919 at the age of two years, was struck by a trolley car, resulting in a traumatic amputation through the heads of the metatarsal bones of the left foot. After the wound became covered with healthy granulations, several attempts were made to skin graft the stump, but as soon as the patient attempted to wear a shoe or bear any weight on the foot ulcerations would develop. In January, 1923, a flap was taken from the right thigh. This covered the stump fairly well, but inasmuch as there was some scar tissue remaining on the sole of the foot, the tendency to ulcerate at this site persisted. Later an attempt was made to excise this and bring normal skin edges together, but this was unsuccessful. In September, 1924, Doctor Beekman took a second flap from the calf of the right leg after excising the scar tissue. This healed very nicely, but as soon as the child began to bear any weight on the extremity ulcerations again appeared. She was kept in bed several months until the ulcerations finally healed. Now, with care in wearing a white cotton stocking instead of a black one she is able to get about, and there is reason to hope that all tendency for the stump to break down has permanently disappeared.

The fifth case, in December, 1920, at the age of eight years, suffered a traumatic amputation involving all the metatarsal bones of the left foot except the first, which was disarticulated at the metatarsophalangeal joint. After healing, the scar on the dorsum of the first metatarsal would ulcerate whenever any kind of a shoe was worn. One year after

the initial injury an attempt was made to tube a flap from the same leg. Due to the incisions in the leg from the original injury, it was impossible to make the flap more than 4 cm. in width, and when the attempt to tube it was made, it was found that in order to suture the tube so much of the subcutaneous tissue would have to be sacrificed that the viability of the flap would be jeopardized, consequently the skin was simply closed beneath the flap and the under surface of the latter was allowed to epithelize. At the end of six months the epithelium had entirely covered the posterior surface of the flap and in several stages at intervals of a few days the upper end of the flap was cut across and swung down and sutured to the normal skin of the stump after excising adjacent scar tissue equal to the end of the flap, the blood supply being derived from the proximal end which was not disturbed. About 2 cm. of the distal end sloughed and they had to wait five months before they excised the remainder of the scar tissue on the dorsum of the foot, splitting the flap longitudinally and spreading it out over the denuded area and suturing it in place. One month later the base of the pedicle was cut across. These various operative procedures were spread over a period of one year. He now has a serviceable foot and with the aid of a properly padded shoe walks very well. A white cotton stocking is worn to prevent subsequent irritation.

This case illustrates the importance of making the flap of sufficient width to tube without tension, but failing in this the possibility of ultimate success by dividing the flap in repeated stages so as not to interfere with the blood supply too much at one sitting. Probably an immediate skin graft of the posterior surface of the foot would have saved this patient considerable time.

The sixth case was a girl who, in April, 1922, at the age of nine, received a third-degree burn resulting in a cicatricial contraction of the neck. This contraction is limited chiefly to a single band about 1 cm. in width extending from the chin to the sternal notch. A plastic operation was performed in February, 1924, the technic being as follows: quadrilateral areas were made on either side of the cicatrix 7 cm. long and 5 cm. wide. The cicatrix was dissected from above downward and left attached at its base. A transverse incision was made in the skin of the chest about 12 cm. long and the skin between the latter and lower end of the neck incision was undermined, this procedure allowing the skin at the base of the neck to be elevated. The flaps in the neck were approximated with horse hair, a portion of the cicatrix being excised, the remainder being used to fill in part of the open area. The wound on the chest was covered with Thiersch grafts.

This case illustrates one of the simple methods of plastic surgery of the neck. Its application seems to be limited to the group of cases where the contracting band is narrow and the amount of scar tissue limited. The fact that a vertical incision remains at the end of the operation is one of its greatest drawbacks.

The seventh case was a girl who at the age of twelve years received a third-degree burn of the neck and chest. There was contraction of the neck with extreme eversion of the lower lip.

In April, 1920, a transverse incision was made through the cicatrix of the right side of the neck and all scar tissue excised down to the fascia, a flap was swung around from the right scapular region which healed per primam. The area from which the flap was taken was later Thiersch grafted. This overcame the deformity of the right side of the neck and lip and our next problem was to get a flap to correct the deformity on the opposite side. The only normal skin in the vicinity lay over the left scapular region, and in

July, 1920 a tubed flap six inches long was made in this region, six weeks later the outer end of the tube was cut across and swung forward to the sterno-clavicle region after excising sufficient tissue to imbed the flap. In November, 1920, the proximal end of the flap was cut and attached to the muco-cutaneous junction of the left lower lip. They now had a tubed flap removed in two stages and attached below in the left sterno-clavicular region and above to the left muco-cutaneous junction of the lip. In December, 1920, the scar tissue beneath the flap was excised, the flap unfolded and sutured into the denuded area. A moderate retraction of the left angle of the mouth persisted, and in November, 1921, a V-shaped incision was made at the base of the transplanted flap and it was slipped upward about 3 cm. This relieved most of the retraction, but the normal crease beneath the lip was missing due to the attachment of the flap directly to the muco-cutaneous junction. To correct this, in November, 1922, an epithelial inlay was inserted which has greatly improved the deformity. This patient represents a sliding flap, tubed flap and epithelial inlay. Of necessity the scars were vertical which, of course, was a handicap. The subcutaneous tissue of the tubed flap remains and is in itself a deformity, for this reason, a full thickness graft might have been a better procedure.

The eighth case was a female child who, in January, 1923, at the age of three years, received second- and third-degree burns of the neck, chest and both arms resulting in cicatricial contractures of the anterior surface of the neck. She was discharged in two months and continued to return to the follow-up clinic at regular intervals, but inasmuch as no operation was advised for some time her parents became restless and took her to another hospital, where she was operated three times in the latter part of 1923.

She was readmitted to Bellevue Hospital in October, 1924. Her previous operations had improved her considerably, but she still had a well marked contracture extending downward from the chin to the chest, limiting extension of the chin and definitely depressing the lower lip. A flap was raised from the right scapular region and then sutured back in place. The distal end sloughed slightly, entailing a wait of several weeks for this to heal before proceeding further. Later transverse incisions were made on either side of the cicatricial band to prevent subsequent vertical contractions and connected by a tunnel, care being taken to have the tunnel posterior to all scar tissue. The flap was now raised again, tubed with the skin surfaces on the inside and passed through the tunnel and sutured. Three weeks later the base of the tube was divided and all raw surfaces sutured. The final stage of the operation was completed by opening the tube, excising the scar tissue and suturing the edges of the tube to the skin of the neck.

This case represents a delayed tubed pedicle flap. The fact that part of the flap sloughed justified the employment of the delayed flap method. The flap was tubed instead of the scar tissue being excised immediately because by tunnelling the cicatricial band well behind the scar tissue and by firmly imbedding the flap they were in a position later to excise more thoroughly all scar tissue and probably preserve more skin than if they had completed the operation in one stage.

An additional factor of safety is that by the time the tube is opened all denuded areas are healed and primary union of all skin edges is practically certain.

The last case was a boy who in 1919, at the age of seven years, was burned by an explosion of gasoline. He had a winter cap and muffler on

FRACTURE OF NECK OF FEMUR

at the time which caused an injury similar to the burns aviators received during the war. When admitted to the Childrens' Surgical Service at Bellevue several months later there were the scars of a third-degree burn of the entire face causing contracture of the mouth to about one-quarter its normal size, ectropion of both lower lids, marked flattening of the nose with contraction of the nostrils and dense scar tissue about each cheek. Attention was first directed to the mouth, lateral incisions were made on either side through the scar tissue, skin and mucous membrane, an attempt being made to identify the muscle at either angle. The skin and mucous membrane were sutured with a fairly satisfactory result. A few months later he was readmitted and Doctor Gillies saw him at this time and suggested radium to soften the scar tissue. This was continued at intervals over a period of two years with considerable softening of all scar tissue. In the fall of 1922, a double epithelial inlay was performed for the ectropion with a fairly satisfactory result.

Radium treatment was continued for several months until the patient left town. In April, 1925, he was readmitted and an effort was made to correct the contour of the nose and upper lip by inserting an inlay at the junction of the nose and lip. Some improvement followed, but as they did not get a hundred per cent take it was not as satisfactory as had been anticipated. An attempt next to correct the eversion of the lower lip by a similar inlay will be made.

Whether a new nose should be attempted by swinging down a flap from the forehead or not is difficult to decide.

FRACTURE OF NECK OF FEMUR—MALUNION OPERATION

DR WILLIAM BARCLAY PARSONS presented a woman, aged forty-eight, who was admitted to the Presbyterian Hospital in October, 1922. She had slipped after alighting from a bus and sustained a Colles fracture of the left wrist and a fracture of the neck of the left femur. It was put up in plaster and abduction, but she proceeded to absorb the neck. The case was left on for three months. She then received massage and was given a walking Thomas brace. She did not begin to walk until six months following the injury, but at the time the X-ray showed fairly complete absorption of the neck of the femur with the greater trochanter almost in contact with the acetabular rim. The head, however, exhibited surprisingly good nutrition and a little fibrous union had occurred as the head would rotate with the shaft.

After six months of activity with the brace no evidence of further repair had occurred, so she was admitted and was operated upon through the Smith Peterson incision. A common wire nail was inserted through the greater trochanter into the head and with a drill several holes were bored through the trochanter into the head. Following this she was kept in a plaster spica for thirty-nine days after which she received massage and exercise and was allowed to walk in her brace.

The facts of most importance were the fibrous union, the loss of distance between the head and shaft, consequent limitation of abduction and her skill in the use of her brace. Inasmuch as the head was in good condition, it was considered wise to attempt to use it rather than to implant the trochanter into the acetabulum.

At the present time, two years after the second operation, there is apparently firm union. She discarded the brace after one year. Measurement shows about $1\frac{1}{2}$ cm of shortening. Flexion and extension are complete at the hip, but there is limitation of flexion at the knee. The recent X-rays show the amount of adduction and abduction possible.

She is shown as an example of a good functional result, following a conservative operation where there had been absence of repair with absorption of the neck in a case of fracture of the neck of the femur

Doctor Parsons then presented a man of forty, who was admitted to the Presbyterian Hospital in April, 1922, complaining of pain in the region of the left hip and marked interference of function. Slightly over a year before in another city he had received a fracture of the hip, presumably an intertrochanteric one, and was at first treated with traction for eleven weeks. No union was obtained, so he was operated on and two nails were inserted. He was then in a cast for thirteen weeks, in bed for six months more and in a chair for three weeks, making a total of nearly one year of incapacity.

When he presented himself at the hospital he had a shortening of $2\frac{1}{2}$ cm. with marked inward rotation and adduction. The muscles of the thigh and calf showed extensive atrophy, and there was considerable limitation of motion at the knee. X-ray at that time showed the two nails driven through the shaft and neck, an angle of about 90° between neck and shaft and an unusual prominence of the greater trochanter. The outlook for a good result from an osteotomy was decidedly compromised by the degree of atrophy and myositis. During this long period of treatment he had received no massage nor graded exercises at any time.

At operation the nails were removed and a wedge-shaped osteotomy done to correct the marked coxa vara. The osteotomy was rather easy on account of distinct atrophy of the bone. An attempt was made to save the hinge on the inner side, but this broke. The leg was put in abduction and external rotation. He was kept in bed in a cast for $3\frac{1}{2}$ months and this was then removed and massage and baking instituted. After five months of bed and chair treatment he was allowed to walk on crutches. The X-ray at that time showed moderate callus formation but apparently union. He was given a walking Thomas brace and continued massage and baking. He used the brace for nearly two years whenever he went out of the house. The X-rays from time to time showed gradual increased density of the bone, but in spite of considerable cooperation on his part there has been comparatively little increase in the size of his left leg.

At the present time, thirty-six months since operation, he has no external rotation of the foot, has complete extension and flexion of the hip and still has some limitation of flexion at the knee. On the other hand, there is no shortening, there is no adduction and no internal rotation. As far as his walking is concerned the interference with muscle action and knee-joint function are the two factors militating against a perfect symptomatic result. He is shown as an example of the bad results following lack of care of the limb as a whole and of the improvement that can be obtained by a comparatively slight operation correcting a not inconsiderable deformity.

EPIPHYSEAL INJURIES AT THE LOWER END OF THE HUMERUS

DR WILLIAM DARRACH read a paper with the above title

DR JOHN J. MOORHEAD said with reference to the occurrence of the swelling in the bend of the elbow to which Doctor Darrach had called attention, it occurred frequently and was not always an early post-traumatic manifestation. Recently he had an opportunity of doing a biopsy in such a case on a boy who had developed a bony lump in front of the elbow which simulated a myositis ossificans. This followed an open reduction of a posterior dislocation of the elbow performed by one of his assistants through a small

TOTAL CYSTECTOMY FOR CARCINOMA OF BLADDER

posterior incision followed by smooth convalescence. There was much controversy as to what caused the pseudo-bony formations following elbow trauma and the speaker's own idea was that the late John B. Murphy has given the real explanation by showing that the elbow capsule consisted of two layers, the inner of which contained embryonal bone cells which became activated following trauma. Whatever the origin, the functional outcome is usually good, and it was unwise to interfere too early with swellings of this sort.

DOCTOR DARRACH, in closing the discussion, said that Doctor Moorhead's suggestion that the induration might be due to periosteal proliferation would only hold in the later weeks. There was X-ray evidence in a few of the cases that this had taken place, but the early deeper induration was probably due to hemorrhage between or superficial to the periosteum with subsequent organization of the clot.

The speaker wished to add that in his experience there was no limitation of pronation and supination.

In summing up the injuries to the lower epiphysis the speaker believed that in addition to the type commonly recognized with displacement of the lower fragment there was a considerable number of cases where the epiphysis was injured with resulting hemorrhage, but without displacement of the lower fragment. Such cases presented the clinical picture of a supracondylar fracture or a displacement of the lower epiphysis except that the X-rays were negative. Therefore where, following an injury, the elbow presented such a clinical picture with swelling, tenderness and limitation of motion with a negative X-ray, the case should be treated with this injury in mind. There should be sufficient protection to the bone with the early establishment of gently guided movements and massage. Of greatest importance is the prognosis and the patient or his parents should be warned that complete restoration of function might not take place for several months. The presence of a deep, firm induration in the neighborhood of the epiphyseal line persisting after the subsidence of the superficial swelling was a symptom which differentiated this group from the ordinary sprain.

The injuries to the epiphysis of the internal epicondyle fell into three groups: those with little if any displacement, those with moderate displacement (5 to 2 cm) and those with marked displacement and sometimes interposition of fragment between the articular surfaces. The latter group and some of the second are often associated with dislocation at the elbow. Open reduction was indicated in the last group and very occasionally in the second.

Stated Meeting Held November 25, 1925

The President, DR. WALTON MARGIN, in the Chair

TOTAL CYSTECTOMY FOR CARCINOMA OF THE BLADDER

DR. EDWIN BEER presented a man thirty-five years of age. Fifteen months prior to admission to the hospital, March 23, 1925, hæmaturia and pain on urination began. This subsided rapidly but two weeks prior to admission the hæmaturia recurred. Hæmaturia was not total, was present

at onset of micturition and at end. Physical examination showed evident loss of weight. By rectum, the prostate and bladder felt like one indurated mass which was definitely ballottable, suggesting neoplasm of both of these organs. Functional kidney test was normal and X-ray of genito-urinary tract was negative. A cystogram X-ray showed an irregular bladder with the bladder circumference raised by an enlarged prostate above the symphysis, and air injection of the bladder showed an irregularity which suggested the presence of tumors projecting into the bladder cavity. Cystoscopy showed a congested bladder holding only three and one-half ounces, full of papillary tumor, partly necrotic and partly fluffy. The left posterior wall seemed to be free from growth. Cystoscopic diagnosis was papillary carcinoma with multiple tumors.

On March 27, 1925, a total cystectomy with removal of seminal vesicles and upper part of prostate was performed. The approach was through a median suprapubic incision. The peritoneum was opened and the viscera explored for metastasis. As none were found, the peritoneum was immediately closed and the bladder mobilized as in the technic described before this Society some years ago. After the bladder was completely mobilized and drawn up over the abdominal wall, the ureters were identified and separated from the tumor mass and subsequently implanted in the iliac fossæ through a gridiron incision. Here they were fixed to the skin and intubated with ureter catheters. The large bladder mass which had been mobilized, felt like a most extensive infiltrating growth suggesting that all the bladder wall was involved in a carcinoma. With the prostate well freed, transfexion stitches of heavy silk were inserted through the prostate as a pedicle and tied where-upon the bladder (unopened), the upper half of prostate and seminal vesicles were removed in one mass. There was some shock from the operation necessitating transfusion. On opening the bladder after its removal, it was found to consist of a very thick bladder wall oedematous in places, and the seat of multiple large and small papillary growths, the largest being situated near the right ureter. Microscopic examination of one of these growths near the neck of the bladder, whose base was very hard, showed papillary carcinoma. Other tumors examined showed benign papilloma. The bladder wall itself showed no extensive infiltration as had been expected from palpation of the organ when in the speaker's hands. The post-operative course was not uneventful as the patient developed chills due apparently to pyelonephritis with colon bacilli temporarily in the circulation. Both sides drained well, and after a temporary attack of pyelonephritis on each side, the urine became fairly clear and the patient was allowed to leave the hospital with his ureters intubated.

In view of the fact that the patient is fairly comfortable and gets along very well, both ureters draining in this way into a receptacle, there is no particular indication for transferring the ureter into his large bowel. If the patient could not be kept dry, as he is at present, this type of implantation might be considered, though results to date in the speaker's hands have not been as satisfactory as when the ureters are implanted into the skin.

MULTIPLE DIVERTICULA OF URINARY BLADDER, WITH STONES

DR EDWIN BEER presented a man, twenty-four years of age, and described the case as follows. The patient had had one year's history of attacks of retention, and one attack of hæmaturia with pain over bladder. He had marked frequency 24 h/3-4 with pain at end of act. The above bleeding lasted a whole week. X-rayed at this time, multiple stones were shown in

MULTIPLE DIVERTICULA OF URINARY BLADDER

the picture in the position of the bladder. He was not cystoscoped, and had no kidney pain. After the skiagraph was taken, he had occasional bleeding, and about eight weeks before he was seen by the reporter, he had a severe attack of pain with terminal bleeding and retention. Control X-ray taken eight weeks ago showed the same shadow, the size of a silver half-dollar. Seven weeks before he was seen by Doctor Bee, a suprapubic cystotomy had been done and no stone was discovered and the necks of several diverticula were felt. Suprapubic drainage was instituted and subsequently an

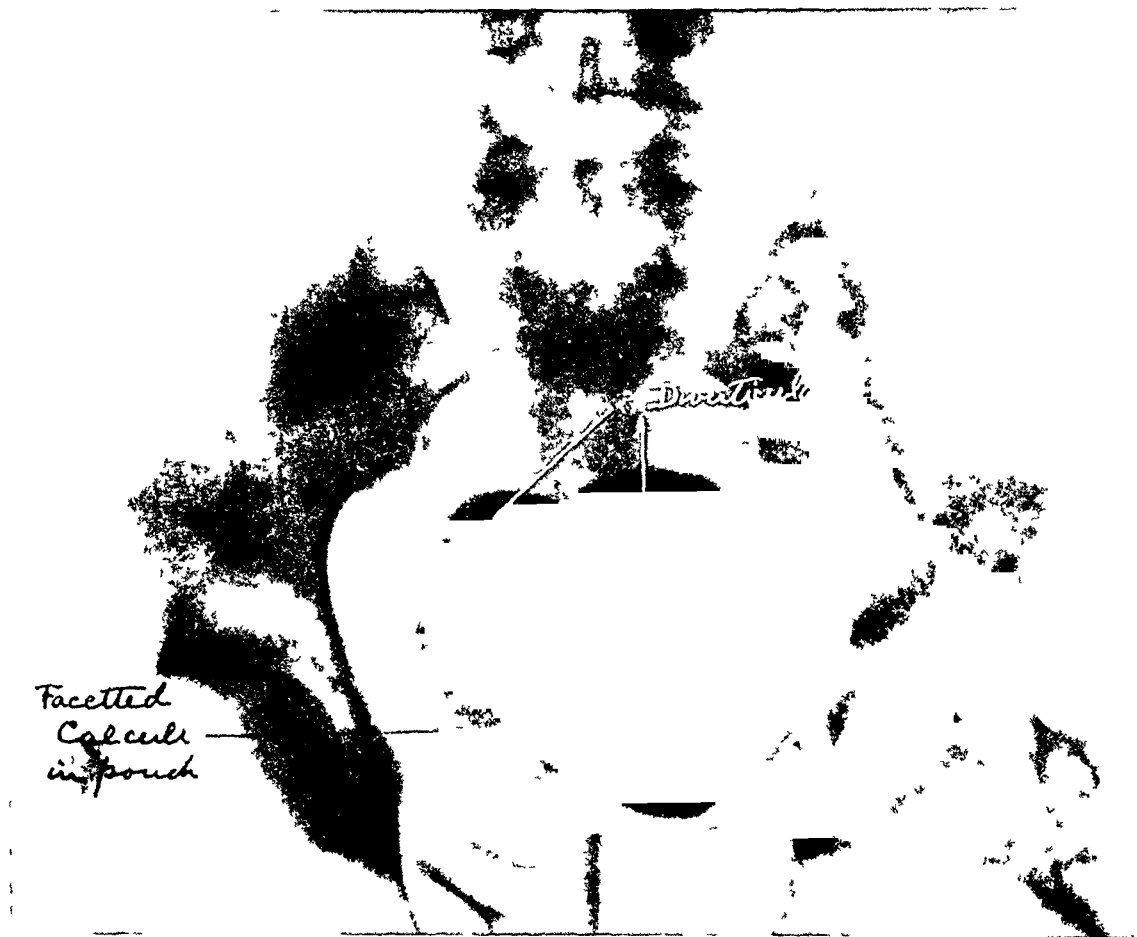


FIG. 1.—Multiple diverticula, one packed with stones. Contracture of neck of bladder.

indwelling catheter was used, but the bladder wound refused to heal, so that when first seen June 8, 1925, he was passing all his urine through the suprapubic sinus and had ten ounces residual, purulent, turbid, foul urine. The sinus was in the centre of the suprapubic scar and when the patient voided ammoniacal urine, it squirted out through this tract. By rectum the prostate was normal. In the position of the left seminal vesicle was a large stony mass which crepitated on palpation. The patient was sent to the hospital and an indwelling catheter introduced prior to operation. Cystoscopic examination prior to operation showed fair indigo-carmin on both sides with no infection of the kidneys. Behind the intra-ureteral ridge there were three diverticula orifices and in the orifice of one a stone could be seen. The bladder was markedly trabeculated and showed an acute cystitis. The neck of the bladder showed typical contraction. X-ray pictures showed practically the same as those taken by other physicians. June 12, 1925, the old incision was opened and the bladder, which was firmly adherent, was exposed with great difficulty, all the way down to the trigone. Three diverticula were

gradually liberated and excised, the orifices being closed by ordinary sutures. One of the diverticula was full of stones. Owing to the extensive peridiverticulitis and the thickening of the bladder-wall to 1 cm., the operation was particularly tedious and the peritoneum was opened in several places. The contracted neck of the bladder was widely stretched. On sewing up the bladder wall after closure of the neck of the diverticula it was completely extra-peritonealized by a flap of parietal peritoneum sewed down to the trigone and to the peritoneum of Douglas' pouch. Patient stood the operation very well, but subsequently developed, due to pelvic exudate, obstructive



FIG 2 —Closely packed stones in hydronephrotic kidney situated in right iliac fossa simulating lower half of a right-sided fused kidney

symptoms which were relieved by Doctor Colp, who did a left subcostal jejunostomy.

The patient was recently seen, his urine is almost clear and is readily passed in good stream. He has been returned to good health.

PARTIAL CYSTECTOMY FOR TUBERCULAR VFSICO-TUBAL-COLONIC FISTULA

DR EDWIN BEER presented a girl, twenty-two years of age, who was first seen October 11, 1923. Two years prior she had had pain on micturition just before menses, which were five-weekly and lasted five to six days. Ten weeks before visit patient had a cold with severe pain in the bladder region, pain being most marked after voiding. She also had noticed well-marked constipation, during this period urine had been cloudy but never bloody. Has lost five pounds in weight and has been running irregular temperatures with occasional chills. Cystoscopy No. 1 showed normal bladder with good function.

TUBERCULAR VESICO-TUBAL-COLONIC FISTULA

on both sides. Behind the trigone there was an area of œdema in the centre of which there was a small body, rather red in color, made up of numerous excrescences looking like a strawberry. On the top of this there was a small accumulation of pus as if the pus was discharging through the bladder wall from an extravascular focus. Vaginal examination showed a thickening to the left of the uterus and running down towards the posterior bladder wall opposite to the area of œdema just described. This gave the impression of a left adnexal disease and the suspicion was aroused that the trouble in the bladder was secondary to the adnexal disease. Subsequent examinations showed the following:

A catheter was passed into the strawberry-like mass on the posterior wall

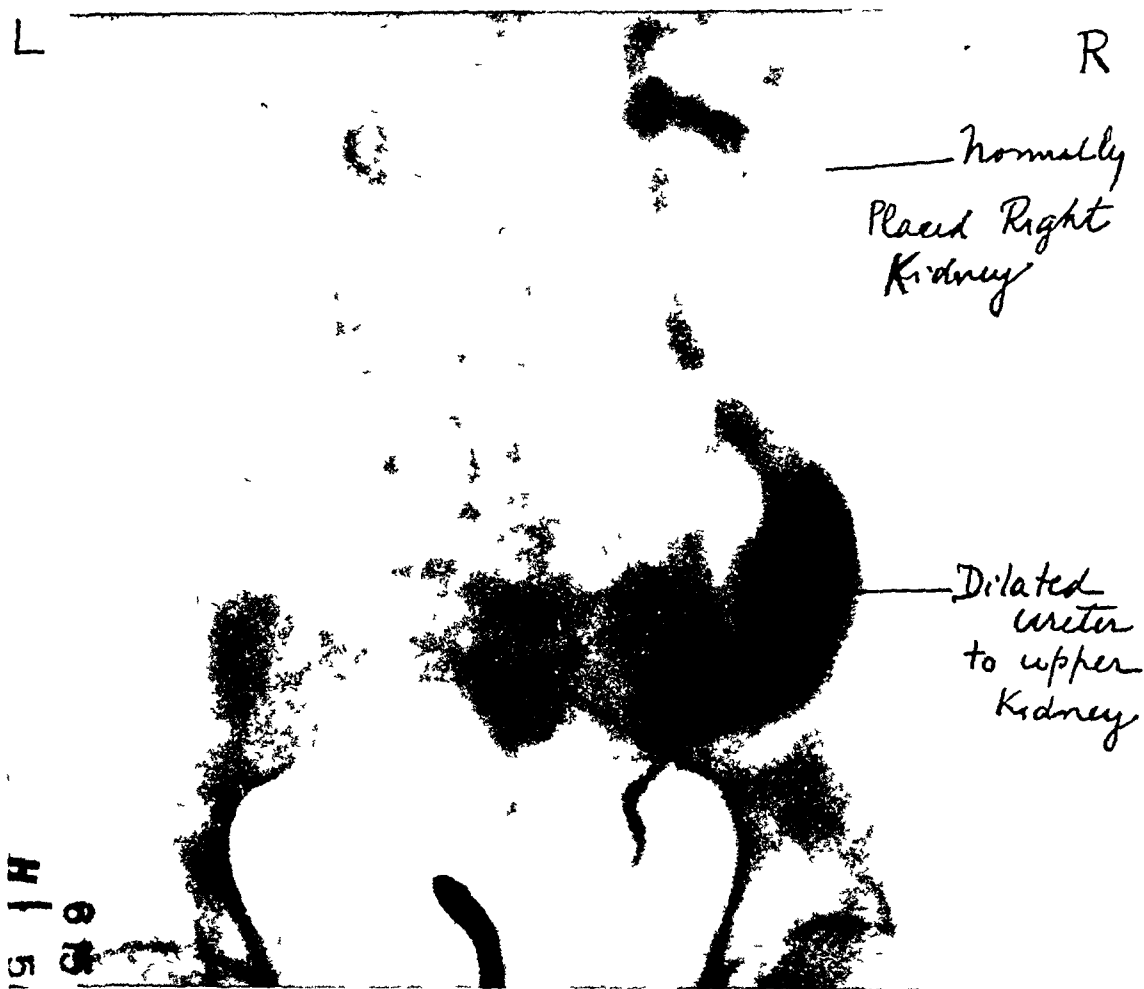


FIG. 3—Infected left calculous hydronephrosis in right iliac fossa

of the bladder a little to the left of the median line, and entered 12 cm. By aspirating the catheter, a quantity of thick creamy pus was withdrawn. Subsequently, three X-ray catheters were passed—one into the abscess which had perforated into the bladder, and one up each ureter—and the catheter in the sinus was injected with iodides. From the X-ray picture it was evident that the two normally placed orifices led to two normally placed kidneys and the catheter in the third orifice ran only a short distance and, when injected, filled an irregular-shaped cavity on the left side of the pelvis and also filled a long horn-shaped cavity running in the right pelvis. The latter cavity, though less distinctly filled, was definitely horn-shaped in character. The operation showed that this incompletely filled horn-shaped body was prob-

ably the transverse colon which had communicated with the extravascular abscess. A specimen removed from the periphery of the fistulous opening of the bladder showed definite tubercle formation. Repeated examinations of the urine failed to demonstrate the tubercle bacilli.

Bringing all the facts together then, the pre-operative study showed definitely the presence of a left tubo-ovarian tuberculosis which had perforated into the bladder. October 23, 1923, a laparotomy was performed, and on exposure, in the Trendelenburg position, the transverse colon was found firmly adherent in a mass of inflammatory tissue on the posterior wall of the

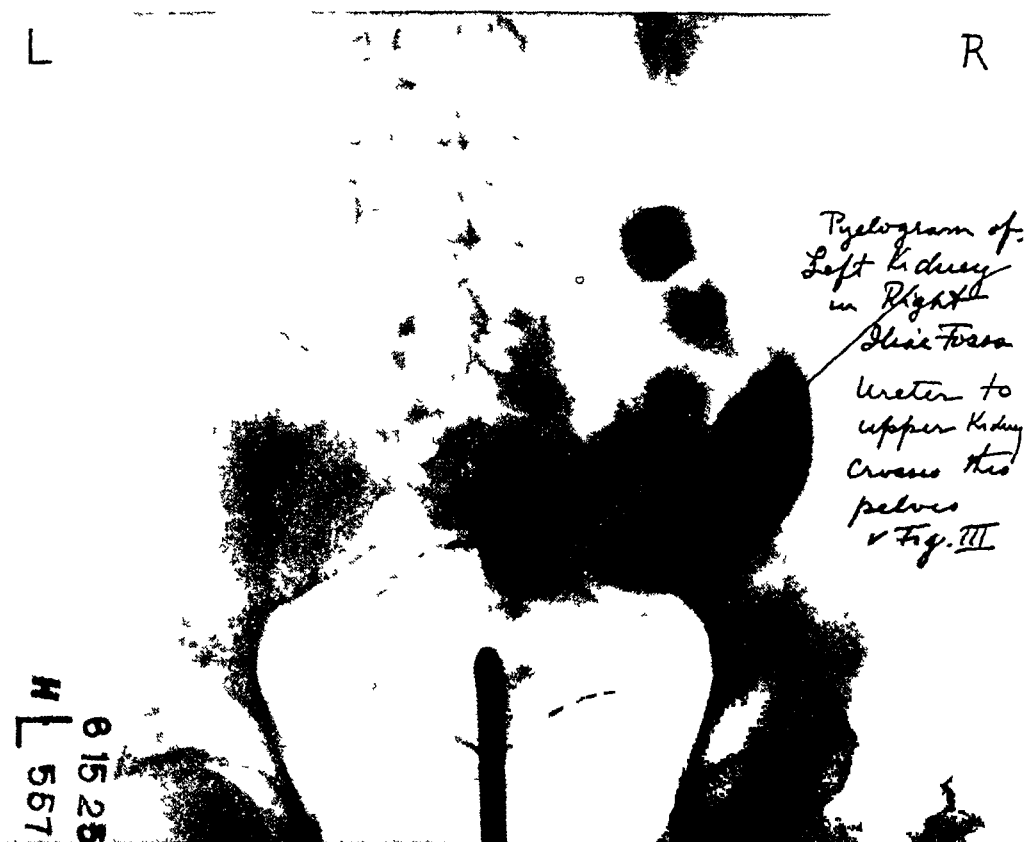


FIG. 4—Infected left calculous hydronephrosis in right iliac fossa

bladder. The colon was cut free and a small opening in the bowel closed. After freeing the colon, it was found that the whole pelvis was covered with tubercles both on the left and right sides, and that the left tube and ovary were matted together in a fan-sized tuberculous abscess. The left tube was cut away from the uterus and followed down to the bladder, and the greater part of the posterior wall of the bladder was removed transperitoneally. In this way the fistulous tract, the left tube, the left ovary and the bladder wall were excised in one piece. The tuberculosis of the peritoneum was so extensive that it was somewhat difficult to close the opening in the bladder. The tissues which were tuberculous had to be reunited to close the defect. To insure closure and to prevent the colon from becoming adherent again to the posterior surface of the bladder, the uterus was suspended against the posterior peritoneal layers of sutures over the bladder. The bladder was closed completely and an indwelling catheter placed in the urethra. The patient made a satisfactory recovery though some exudate developed in the left iliac fossa which caused a little distress, some discharge and occasional rises in tempera-

TUBERCULOSIS OF THE CÆCUM

ture This is not surprising in view of the fact that the abscess contained pus germs derived from the bowel as well as germs of the original disease. Reexamination with the cystoscope showed on the posterior wall the line of resection and near the centre of this a superficial ulceration such as one sees occasionally in the bladders of patients who have had renal tuberculosis. The suprapubic sinus closed completely and all the exudate has disappeared. Recent cystoscopy following cauterization of the ulcer with the high frequency current showed a healthy normal bladder.

INFECTED LEFT CALCULOUS HYDRONEPHROSIS IN RIGHT ILIAC FOSSA

DR EDWIN BEER presented a man, forty-five years of age, who was first seen June 11, 1925. For two months he had been suffering from pain in the right lumbar region. There had been no hæmaturia and no stones passed in urine. An X-ray (Fig 2) showed a closely grouped mass of faceted stones as large as peas on the right side of abdomen opposite the lower lumbar spine and partly overlying the iliac bone. There had never been jaundice and no disturbance in micturition. He had lost six to seven pounds. Further X-ray studies showed the above group of stones broken up so that they were scattered over a wide area. On cystoscopy, the bladder urine was found clear, ureters normal. The left ureter admitted a No 4 Fr catheter 35 cm, and there was no indigo-carmin excretion in forty-five minutes. The urine obtained from this side was clear macroscopically and contained 7 per cent urea and an occasional leucocyte. There was slight retention in this pelvis. On the right side there was clear urine, no retention, no obstruction, faint indigo-carmin excretion, clear urine. Abdominal palpation showed a definite resistance in the right iliac fossa where on some examinations a definite mass could be felt.

In view of the X-ray findings and the above cystoscopy findings, the problem was to decide between a large number of faceted stones in a gall-bladder of large size, or whether there was a fused kidney which was hydronephrotic, the lower pole of which communicated by means of the left ureter with the bladder, the whole kidney being situated to the right of the spine. Further examination with the assistance of X-ray showed that the left ureter crossed the spine to the lower pole of the right kidney and this lower pole was converted into a hydronephrosis in which the stones lay. A pyelogram of what was thought to be the upper end of the fused kidney, showed this pelvis to be normal, but that the ureter was markedly dilated in the position of the hydronephrotic lower half of this kidney.

June 16, 1925, a retroperitoneal exposure was made of the hydronephrotic kidney through an anterior incision, the peritoneum being easily pushed back. The two kidneys were in no wise connected. The left kidney was found in the right iliac fossa and the ureter of the right kidney crossed this dilated pelvis over its anterior surface. The vessels entered this kidney through the upper mesial aspect. The nephrectomy was comparatively simple and the patient made an uneventful recovery. The wound healed by primary union.

TUBERCULOSIS OF THE CÆCUM

DR EDWARD WADSWORTH PETERSON presented a man now forty-seven years of age, who was admitted to the Post-Graduate Hospital in June, 1918.

His chief symptoms were a gradual loss of weight, occasional attacks of pain in the right upper quadrant of the abdomen, the pain radiating to back and shoulders, and for several months frequent discomfort in the right lower quadrant of the abdomen, accompanying a desire to go to stool and relieved

by bowel movement. Physical examination was negative except for a tumor in the gall-bladder region and tenderness and slight resistance over the right lower quadrant. The gastro-intestinal X-ray study was negative except for a slight filling defect in the cæcum.

Operation, July 11, 1918, revealed a large hydrops of the gall-bladder, due to an impacted stone in the cystic duct. There were a moderate number of tubercle-like bodies on the cæcum and on the mesentery in the ileo-cæcal region. The appendix and gall-bladder were removed. The pathological report showed a tuberculosis of the appendix, and a chronic cholecystitis. At the time of operation the tuberculosis was thought to be of the "peritoneal" and not of the "entero-peritoneal variety," which manifested itself a few months later.

The man recovered promptly from the operation, left the hospital two weeks later and improved for a few weeks. He was readmitted to the hospital with symptoms of intestinal obstruction, and was operated upon by the late Dr. Walter Silleck, in January, 1919. There was exposed a massive infiltration of the cæcum and ascending colon and the mesentery of the right side, giving the impression of an advanced malignancy in this region. The condition was considered inoperable and the abdomen closed. Evidently a massive hyperplastic tuberculosis had developed. Intensive X-ray treatment was advised and was followed by disappearance of all the tumefaction of the right side of abdomen and by a complete relief of all abdominal symptoms.

The patient considered himself perfectly well for over six years. Early in 1925, he began to have trouble with his bowels. There were intermittent, cramp-like pains, and a feeling of fulness and flatulence. In July, 1925, he had an attack of constipation, abdominal distention, vomiting and rapid loss of weight. He was again sent to the Post-Graduate Hospital, seven years after his original operation, suffering with partial intestinal obstruction. An exploratory operation showed thickening of the ileo-cæcal valve region and head of cæcum, numerous scars on cæcum and ascending colon and mesentery, but except for the ileo-cæcal thickening, there was a complete disappearance of all evidence of the massive hyperplastic tuberculosis which had been encountered at the second operation.

A resection of the cæcum would have been the operation of choice at this time, but owing to the weakened condition of the patient and the possibility of lighting up old apparently healed tuberculous foci, a palliative operation was decided upon. A lateral anastomosis between the ileum and the transverse colon was made. Patient recovered rapidly, has gained considerable weight, bowels move regularly and there is freedom from all unpleasant symptoms. X-ray therapy is being used again.

CORNEAL ULCER AFTER ALCOHOL INJECTION OF GASSERIAN GANGLION

DOCTOR PETERSON presented a man, thirty-five years of age, who had suffered from tic douloureux, right side of face, for seven years when first seen. The neuralgia attacks would start in the second division of the fifth nerve and spread downward to the third branch. The attacks were of such frequency and severity that the patient had been forced to give up his work.

In June, 1919, a deep alcohol injection of the second and third branches of the trifacial nerve gave relief for about one year. Then pain returned.

CORNEAL ULCER

and, if anything, was more severe than formerly. All three branches of the fifth nerve were now involved in the attacks.

September 25, 1920, a deliberate attempt was made to puncture and inject the right Gasserian ganglion. The effort was successful, as evidenced by the immediate complete anæsthesia and analgesia of the whole side of face and head. A rather severe neuro-trophic keratitis manifested itself several days later and in spite of prophylactic treatment went on to development of a corneal ulcer. There was also headache and temperature for a few days, but all symptoms cleared up. There had been not the slightest suggestion of tic douloureux since the injection. Anæsthesia and analgesia had persisted for over five years.

The average period of relief following the deep injection has been from six months to one year, in exceptional cases much longer. After successful ganglion puncture and injection—as evidenced by immediate anæsthesia and analgesia of all three divisions of the fifth cranial nerve, followed later by neuro-tropic keratitis—the effect was much more lasting, and in some instances the cure seemed permanent. The shortest period of relief was over four years in his cases.

He no longer performs this operation, however, believing the division of the posterior root, according to the Cushing or Frasier technic was safer and more certain and the relief of the pain was permanent.

DR HERMAN FISCHER, speaking about the treatment of trigeminal neuralgia with alcohol injections, said that he had had the opportunity to treat about fifty of such cases and in general the results were quite satisfactory. He never injected the Gasserian ganglion and he believed that alcohol injections into the Gasserian ganglion had been given up by most surgeons, on account of its dangers and the uncertainty to guide the needle. He personally knew of serious results in two cases, in one, a subdural abscess developed, and in the other a physician, well known in New York, developed multiple brain abscess with fatal termination after a number of such injections. In most of his cases the second branch was involved and many patients became entirely free after one injection into the infra-orbital foramen and remained so for a number of years. In about one-half of the cases the pain recurs after a shorter or longer interval. After they have been injected several times, however, they rarely get a long interval of relief, the longest period being about six to seven months. A third injection rarely does any good whatever. In such cases the speaker usually recommends resection of the nerve and after the operation a good many patients in whom the alcohol injections failed were cured. In none of the cases has he had the opportunity to do a section of the posterior root of the ganglion. He had one case, a man who had recurrence of the tic four or five times and an effort was made to persuade him to have ganglion section done but he refused to consider it. He later came back and an excision of the nerve was done. He still had pain when he left the hospital, but two weeks later reported that he was absolutely free of pain and has remained so ever since.

The speaker is of the opinion that root section should be reserved for the cases which cannot be cured by these simpler methods.

margin of the joint When this could be seen and felt the knee would remain bent until by pressure and manipulation this small mass reentered the joint The mass extruded particularly when he was playing golf Examination showed a swollen knee which lacked about 50 per cent of full flexion and which showed some tenderness over the internal semi-lunar cartilage X-ray examination was negative There was no calculus palpable November 9, a medio-lateral arthiotomy was done at the Post-Graduate Hospital and a fracture of the internal semi-lunar was found, the inner edge of the cartilage was curled upon itself and was attached to the main portion of the cartilage by a thin band and in certain motions of the joint this attached portion extruded itself The synovia was thickened and some of the fat pads were enlarged It is now sixteen days since his operation and he is exhibited as a recent post-operative case to show the immediate after-effect of such an operation and the range of motion obtained by the practice of immediate post-operative mobilization As will be observed the joint is swollen and he is able to bend it to a little more than a right angle This appearance corresponds to what is seen of the majority of cases and as the peri-arthritis subsides the motion will increase so that at the end of three or four weeks more he will doubtless have practically a normal appearing and normal acting knee

DR CHARLES GORDON HYD asked Doctor Moorhead if he favored a smaller incision in simple dislocation of the internal cartilage The Jones incision has given excellent results with a minimal degree of deformity In regard to the patella split, while it gives a most admirable exposure of the joint and the ligaments it represents a prolonged hospitalization and a long period of disability before free movement is obtained During the war he had recourse to a parapatella incision, one that extended on either side of the patella and did not bend either above or below the patella The exposure was adequate and the recovery with active mobilization surprisingly rapid Doctor Moorhead's operation had all the advantages of a very beautiful exposure and the application of surgical principles was comparable to those that govern work in the abdomen It is surprising to notice from the tabulated statistics the remarkably early return of these patients to their feet with comparative comfort The patient presented illustrated this very well He was operated upon November 9, just sixteen days ago, and he walks with as slight a limp as would ensue after a laparotomy There has been too great a tendency to regard the knee-joint as a place not to be entered This is an erroneous idea, for which proper aseptic and precautionary technic the knee-joint lends itself quite as readily to surgery as the abdomen and the return to function is excellent and within a remarkably short period of time

DR FREDERIC W BANCROFT said that it was surprising how large these foreign bodies in the knee-joint can be In one of his cases the patient had had a foreign body one and one-half by one-half inch in diameter removed from the supra-patella bursa This foreign body appeared like a joint cartilage which had had increasing amounts of calcium deposited around it It had had no pedicle and was free in the joint Doctor Bancroft

ARTHROTOMY FOR KNEE-JOINT CALCULI

showed the lantern slides of this case. High-powered photomicrographs revealed a connective-tissue membrane with nuclei present in the cells. Beneath the membrane were numerous cartilage and bone cells with active staining nuclei. The centre consisted of a morphorous calcareous material. He stated that the bone must obviously have a low metabolic rate for the cells to retain their nourishment without any active circulation. The cells must have obtained their nourishment from the seepage of the synovial fluid. This low metabolic rate may explain why the nuclei of the cells in a bone transplant occasionally maintain their nuclear stain after insertion.

CORRESPONDENCE

ISOLATED DISLOCATION OF THE FIRST METATARSAL BONE

EDITOR ANNALS OF SURGERY

Sir

Isolated dislocations of the first metatarsal bone are quite rare in the literature. In 1915, when the following case was seen, only 16 cases were



FIG. 1.—Isolated dislocation of the first metatarsal bone

found in the records. There are probably many others unrecorded, especially since the Great War, as most of these injuries are caused by falling from a horse or by severe direct trauma. My case occurred in the person of a laboring man, thirty-five years of age, who was struck on the top of the foot by a

CORRESPONDENCE

barrel Great pain ensued and the man was unable to walk He was seen immediately The foot was found markedly foreshortened and with an extremely high arch The first metatarsal bone was palpated as dislocated internally and upward X-rays confirmed the diagnosis Nitrous oxide was administered and the metatarsal bone reduced with great ease The arch at once returned to normal and the foot resumed its normal appearance A support was worn for about six weeks and the ultimate result was a complete cure The X-rays show a complete dislocation of the first metatarsal from the others and from the tarsus, without fracture

CHARLES E. FARR, M.D.,
New York, N. Y.

ACTIVE MOTION IN THE TREATMENT OF FRACTURES

EDITOR ANNALS OF SURGERY

Sir

As late Surgeon and now Consulting Surgeon to the Edinburgh Royal Infirmary, I was exceedingly interested to think that the principle of active movement had been considered in America The article published in the October number, 1925, on "Active Motion in the Treatment of Fractures," by Doctor Stevens and Doctor Yates, is of great interest as this method of treatment has been taught and practiced by me for twenty-five years, and there are now many medical men all over the world who are carrying out this method of treatment The results have been so uniformly rapid and good that I cannot understand why it has not more speedily gained hold In December, 1924, Oliver and Boyd, of this city, published a work by me entitled, "The Principle of Active Movement in the Treatment of Fractures of the Upper Extremity," and this embodied my experience of twenty-five years The treatment, in short, consists in active movement, short of pain, constantly and frequently carried out No splints are used except in the first few nights to prevent painful displacement Even if displacement occurs, it straightens out during the day The forearm is supported by a sling and the angle at the elbow frequently altered to prevent stiffness in that joint

Take a case of fractured clavicle Such a patient ought to be able to return to work as a clerk in a matter of a week, putting on his own clothes, opening the door, and writing quite well If it was considered quite apart from Surgery, what an advantage this is to a married man to be again a wage-earner in a short time But that is not the only point to look at Think what an asset it is to a State and to Insurance companies if such a man can be back to work a week sooner than by other treatment, and with a better result A hundred fractures a year going to work a week earlier means a hundred weeks more work for the State in a year

So impressed have I been in comparison with other methods of treatment, that I consider active movement short of pain to be a new principle in Sur-

gery, and I have applied it with the greatest success in the suture of divided tendons, the use of the knee-joint after removal of the semi-lunar cartilage, and in cellulitis affecting muscles, where the active movement short of pain helps to "pump" out the pus. Suppurating joints I have treated always on this principle and have had most excellent results except where the bacillus pyocyaneus is present, an organism very fatal to cartilage.

There is no hesitation in saying that this principle is a great advance on splints, massage and passive movement, which are the use of another person's muscles and brain and not the sufferer's.

J W DOWDEN, M D,
Edinburgh, Scotland

THE EXCISION OF INTERNAL HEMORRHOIDS

EDITOR ANNALS OF SURGERY

SIR

Thirty years ago, after having discarded the use of the clamp and cautery and Whitehead's operation in the removal of hemorrhoids, while I was casting about for some more satisfactory method I saw a statement by Gallant

(*Mathews' Medical Quarterly*, October, 1894), that Doctor Outerbridge had been excising individual pile tumors and closing the wound with catgut sutures. This appealed to me very strongly, and after having followed it for some time it

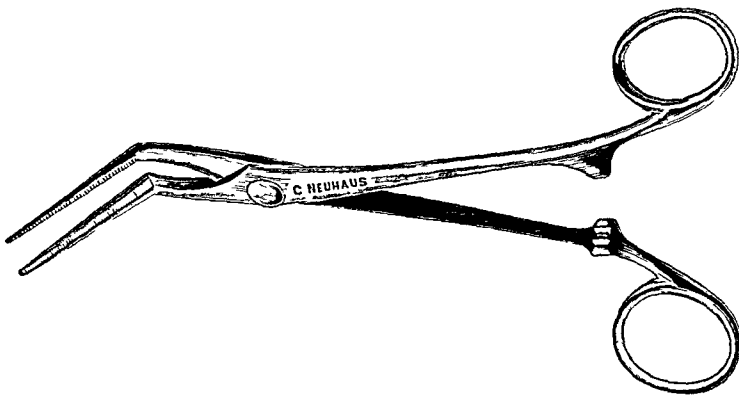


FIG 1 — Forceps for compressing the base of hemorrhoids

occurred to me that I might do it much more satisfactorily and speedily if the hemorrhoid could be held by a clamp while being sewed and excised. This would facilitate also preventing the opposite walls of the adjacent hemorrhoids from being included in the sutures of the wound that was being closed. This was accomplished by devising the pile forceps shown in the accompanying cut (Fig 1). These forceps have conical-shaped blades, adjusted to the handles at an angle of about thirty degrees with serrated edges, but not stout enough to bruise the tissue when closed by the catches at the base of the handle.

A similar suggestion had occurred to Doctor Parkhill about the same time without his having known anything of what I had done. In order to authenticate the right of priority I give the dates on which each method was first published.

CORRESPONDENCE

Earle, *Mathews' Medical Quarterly*, January, 1896 Paikhill, *International Journal of Surgery*, May, 1900

Earle's Method—With the patient prepared for operation in the usual manner and the patient placed under either a general or local anæsthetic and the parts thoroughly cleansed, the hemorrhoids are caught either with a Kelly or a T-forceps and dragged down well out of the anal canal. Each internal hemorrhoid is then caught with the Earle clamp at its base, in the line of the long axis of the rectum, a needle with a number two chromic catgut suture is then passed back and forth beneath the toe of the clamp and tied, the suturing is then continued back and forth until it reaches the heel of the forceps when the portion of the hemorrhoid above the clamp is cut off with a sharp knife as close as possible to the blades of the forceps, the forceps are then removed and the suture tied at the base. Each succeeding hemorrhoid is dealt with in the same manner (Fig 95)

It is to be remembered that the clamp is not to include any but the internal hemorrhoids down to Hilton's white line. If there are external hemorrhoids, or skin tags, they are to be dealt with separately as follows

If the external anal ring is surrounded by large clusters of varicosities, I take a horizontal strip of skin from each side of the anal canal, extending from the anterior to the posterior commissure and with mouse-tooth forceps and scissors I dissect out all the varicosities with the superabundant tissue, and tie with plain catgut all spouting vessels. I then remove sufficient of the superabundant skin to allow the cut edges to approximate each other nicely. Later applying a compress after the thighs have been extended and brought together which will keep the cut edges neatly approximated.

If there are only a few and distinct clusters of varicosities I take out an elliptical piece of skin parallel with the rugæ of the skin made by the contraction of the sphincter from the most prominent part of each and dissect out the varicosities as before described. I also remove a sufficient amount of redundant skin to make these cut edges approximate evenly.

If there are only skin tags I cut them off, being careful to remove sufficient amount of redundant skin at their base to make the cut edges approximate evenly.

I then give a sixth or a quarter of a grain of morphia hypodermically and repeat at proper intervals as required by the pain, which will also confine the bowels until the fourth day, it is generally only necessary to give one, or two hypodermics. I only confine the patients to liquid and soft diet for the first day after the operation, then give them fruit and vegetables. I begin with liquid petrolatum in ounce doses the second night after the operation and continue it until the patient is well.

I apply to the wound the following day after the operation Pilcher's quimo-formol solution which is a less irritating than the chlorinated solution of Dakin, this is applied with a sponge which is renewed every two or three hours during the day. On the morning of the fourth day I give a mild laxative to be followed by an enema of one pint of plain tepid water after

there has been some inclination for a movement of the bowels. The patient is allowed to be up on the third day and generally leaves the hospital from the fifth to the seventh day.

This method was again fully described by me with illustrations in my book on *Diseases of the Anus, Rectum and Sigmoid*, published in 1911 by J. B. Lippincott Company.

SAMUEL T. EARLE, M.D.,
BALTIMORE, MD.

AMOEBI ABSCCESS OF LIVER WITH RUPTURE INTO INFERIOR VENA CAVA

EDITOR ANNALS OF SURGERY

Sir

A survey of the literature shows that amœbic abscess of the liver with perforation into the inferior vena cava is extremely rare. Flexner,¹ in 1897, in reporting two cases, states that he found only one other reported case, that of Colin in 1873. Cyr's statistics, quoted by Strong,² show that of 159 cases rupture occurred into the lung in 59, into the pleural cavity in 31, into the peritoneal cavity in 39, into the intestine in 8, into the stomach in 8, into the vena cava in 3, into the kidneys in 2, into the bile ducts in 4, into the pericardium in 1, externally in 2. No more recent cases have been found. The condition has probably never been recognized during life. To the following recent case therefore must attach much interest.

E. G., single, white, machinist, aged twenty-two, was admitted to the Louisville City Hospital, July 25, 1925, with a diagnosis of acute cholecystitis. His personal history was of no consequence except for a similar attack eight months before. There was no history of dysentery and he had never been south of Kentucky. Illness began five weeks before admission with drowsiness, anorexia and loss of strength and of weight. Three weeks later he began to have dull, gnawing, intermittent pain in midline of epigastrium, radiating around right costal margin. Pain was worse at night. Vomiting of food and blood-streaked bile occurred about thirty minutes after meals. About a week before admission he became jaundiced, this persisting for three days. Following this were chills and fever with swelling of feet. About an hour before admission he was seized with a severe cramping pain in right upper quadrant.

Physical examination on admission showed nothing abnormal in the thorax and lungs except slight limitation of motion at the right base. There was a fullness in the right upper quadrant of the abdomen. Palpation revealed a tender mass the size of a half grapefruit extending downward from beneath the costal margin. There was very little muscle rigidity. Temperature was 100, pulse 130. A blood count showed red blood-cells, 2,500,000, white blood-cells, 18,400, with 82 per cent polymorphonuclears. A diagnosis of acute cholecystitis was made and operation advised. This was refused. The next day he was given a transfusion of 500 c.c. of citrated blood following which red blood-cells rose to 3,100,000, white blood-cells to 25,200, and his condition seemed improved.

Operation was accepted July 28, 1925. The laparotomy revealed a large liver extending nearly to the crest of the ilium, with delicate adhesions to surrounding structures. The gall-bladder, appendix and pancreas were negative. A prominent, firm area

CORRESPONDENCE

in the right lobe of the liver, high up under the costal margin, almost in the midline, was aspirated and thick yellow pus obtained. Incision along the needle opened an enormous cavity in the right lobe, from which much pus was evacuated. From this cavity severe hemorrhage began which could be controlled only by firm packing. Due to the precarious condition of the patient, the wound was hurriedly closed, leaving the packing in place. Careful warm stage examinations of the material showed cell debris, red blood corpuscles and a few pus cells, but no amœbæ. Smears and cultures were negative. Blood culture August 12 was sterile. August 15, 200 c.c. of bloody fluid was aspirated from the right pleural cavity. No amœbæ were found in this fluid and cultures were sterile. Death occurred August 18 with signs of respiratory failure.

At autopsy two hours post-mortem the peritoneal cavity was found to be normal except in the right upper quadrant, where intestines and omentum were matted to the gall-bladder by a fibrinous exudate and delicate fibrous adhesions. The liver margin extended to the umbilicus in the midline and was firmly adhered to the abdominal wall. The diaphragm extended to the third rib on the right and the third interspace on the left. The right pleural cavity contained about 1000 c.c. of blood stained fluid. The left contained about 200 c.c. of similar fluid. The gastro-intestinal tract showed no signs of fresh or healed ulceration. The liver, after drainage of the abscess, weighed 3130 gms. Practically the whole of the right lobe was destroyed by the abscess, which contained about 2000 c.c. of typical thick, reddish-brown, anchovy sauce fluid. Upon removing the liver this fluid poured from the upper end of the portion of vena cava included with the liver. The lower end of this portion of vena cava was partly occluded by an adherent thrombus. The vena cava above this thrombus communicated through a ragged opening 1 cm. in diameter with the cavity in the right lobe of the liver. The intima of the vena cava at this point was covered with a shaggy fibrinous exudate. The thrombus in the vena cava partially filled its lumen to a point 3 cm. below the bifurcation. The walls of the abscess averaged 2 cm. in thickness, the inner zone composed of firm, fibrous tissue, surrounded by compressed liver tissue.

Many motile amœbæ *hystolitica* were found in scrapings from the walls of the abscess. Cultures from the abscess showed *staphylococcus albus*.

STUART GRAVES, M.D.,
Louisville, Ky

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- ¹ Flexner, Simon. Perforation of the Inferior Vena Cava in Amœbic Abscesses of the Liver. *Am J M Sc*, May, 1897.
- ² Strong, Richard P. *Nelson Medicine*, vol. 11, p. 331S.

BOOK REVIEWS

PLASTIC SURGERY OF THE NOSE By J EASTMAN SHEEHAN, M D, Chief of Nose and Throat Clinic of the New York Post-Graduate Medical School and Hospital 8vo, cloth, pp 245 Paul B Hoeber, Inc, New York, 1925

This volume of 245 pages is devoted entirely to the plastic surgery of the nose. The object of the book is to present as systematically as possible a series of procedures for the correction of nasal deformities that have been almost completely standardized. There are fifteen chapters, namely Introduction, which contains many important general principals, The Nose, which considers the origin of deformities and a comprehensive Table of Corrections, Preparation of the Patient, Typical Operation giving the Reduction of Hump Nose, Correction of Twisted Nose, Depression of Nasal Bridge, Deformities of the Nose Tip, Deflected Septum, Deformities of the Alæ, Methods of Treatment of Rhinophyma, Paraffinoma and Recent Injuries, The Syphilitic Nose, Rhinoplasty, Skin Grafts, Occasional Disfigurements—and lastly the Appendix in which Intratracheal Insufflation in Anæsthesia is considered.

The author has devoted the past six years to this very special branch of surgery. After reading the book it is readily realized that constant application to this type of work is indeed necessary. It is the application of sound principles of anatomy and surgery by a well-trained capable surgeon. The importance of this kind of work is evident because at the present time many of the great hospitals and schools of medicine are applying themselves to this particular task. As an example of an extremely highly specialized type of work, this book is most sincerely commended.

MERRILL N FOOTE

ABDOMINAL OPERATIONS By SIR BERKELEY MOYNIHAN Fourth revised edition, in two octavo volumes W B Saunders Co, Philadelphia and London, 1926

Since the publication of the first edition of this work in 1905, twenty years have elapsed, during which time revolutionary strides have been made in all aspects of abdominal surgery. This has been particularly evident during the last decade, dealing not only in changes of standardized operative procedure but in pre-operative and post-operative care of cases.

The presentation of the subject of abdominal operations by Sir Berkeley Moynihan, not only represents naturally the present-day concept of surgery in England as practiced by its most prominent exponent, but in addition that of all other nations, owing to the wealth of references and the endeavor of the author to properly credit other surgeons with operative procedures and items of technic devised by them. Any and all methods which are not actively used by surgeons in general have been omitted. Thus it is to be noted that

the technic of the use of buttons and bobbins in stomach and intestinal operations has been deleted, as has any other reference to the use of mechanical appliances for anastomosis

The general scope of the two volumes embraces only those operations common to both sexes, there being no consideration of gynæcological operations or of any organs not entirely intraperitoneal. Thus the work does not include any reference to surgery of the kidney or bladder and similarly the subject of hernial repair has been omitted.

The first section of the three, comprising volume 1, takes up the item of General Considerations in the utmost detail, as the author feels that on a proper realization of these elements depends, in a great many instances, the success of the case in question, and conversely misobseivance or misconception of them frequently results in the disaster which not infrequently follows a perfectly executed technical operation. Eight chapters are included, in this section, covering the consideration of the bacteriology of the stomach and intestines, the pre-operative preparation, the conduct of the operation itself and the after-treatment of the patient. This is followed by an exhaustive chapter on the complications and sequelæ of abdominal operations in which the question of etiology and treatment of such major occurrences as peritonitis, lung complications, parotitis, post-operative hæmatomesis, acute dilatation of the stomach, phlebitis and thrombosis, post-operative obstruction, acidosis and ketosis are carefully considered, knowledge of which processes is not only absolutely essential to a favorable outcome, but which may lead to the institution of prophylactic measures which, if exhibited early enough, will frequently anticipate and, in many instances, prevent their development and establishment. Treatment of gunshot wounds of the abdomen and specific indications of wounds of the various viscera is followed by the consideration of tuberculous peritonitis and subphrenic abscess and finally the various surgical procedures to combat visceral prolapse and intestinal stasis. In the latter instance the author believes that when surgery is indicated, an ileocolic resection as far as the hepatic flexure answers all purposes and is far safer than the more formidable colectomy which Lane practices. An interesting controversy is engendered by the author's non-acceptance of the far-reaching tenets of Lane and the clear-sighted normal, conservative position taken by him surely reflects the opinions generally held.

The enormous experience of the author in dealing with pathologic conditions of the stomach and duodenum is related in the second section of volume one, comprising thirteen chapters, and reflects to a large degree his consideration of this subject in his previous well-known publications dealing with the same problems. It is to be noted that in the light of late sequelæ in conservatively treated cases of gastric ulcer, the author feels that the only rational procedure in these cases is a gastrectomy. The profusion and clearness of the illustrations of the various steps of operation and subsequent anastomosis are very commendable. This applies equally well to the succeeding section on the subject of operations upon the intestines which comprises

BOOK REVIEWS

six chapters in the first volume and is continued in volume 2 by the introduction of nine more chapters. The subject matter in no way departs from the principles generally accepted and the newer procedures which have been demonstrated as most feasible have been introduced.

The remainder of volume 2 contains the consideration of operations upon the liver, pancreas and spleen. The wealth of material afforded the author enables him to speak with authority on the many complicated conditions and with particular directness relative to their proper treatment. Throughout the entire volume is noted new, rearranged or revised subject matter which is the result of the recognition of newer methods and the judgment gained from a still broader experience. The recitation of case histories not only quoted from personal cases but of experiences of other surgeons gives the book a clinical character that lends itself to the interest of the reader and is somewhat of a departure from the usual works on abdominal surgery.

JAMES T. PILCHER

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THE MANAGEMENT OF ADVANCED CANCER OF THE STOMACH

BY NATHAN W GREEN, M D

OF NEW YORK, N Y

THE purpose of this article is to show what effort has been made in a non-surgical way, or in a physiotherapeutic way, combined with surgery, in the control of cancer of the stomach during the ten years previous to 1925. The study is based upon experience during the past four years while in charge of the Gastric Service at the Memorial Hospital, and covers one hundred and twenty-one cases. It deals principally with what may well be termed advanced inoperable carcinoma of the stomach. The study of this condition has presented one of the most interesting and at the same time one of the most difficult problems with which the physician and surgeon has to deal, and is wrapped up with the diagnostic means, and with the treatment, both medical, palliative, and surgical. Although there has been some amelioration in some instances, the end-results have been far from encouraging. Yet we find cases that have led us to hope confidently that at some future day the outcome may be well worth the combined efforts devoted to the subject. Looking back over this field, we see pass in review a host of therapeutic agents marshalled to cope with this condition. Occasionally procedures appear to have been attempted which seem to have submerged the humanitarian phase of the problem. In our work we were unwilling to duplicate or to approximate these. We doubt if there is any clinic where material effort is being made in this question of advanced cancer where more is being accomplished than in this country. We do not wish to lead our readers through a mine of ill-observed and immaturely reported material. From a patient review of the literature of the past ten years we have found in many instances that the conclusions were founded upon observations that were not checked up by all available methods of certainty. Many claims of cure that led to hope have not been of cases proven by microscopical section. This criticism may also be made in some of our own cases, our excuse being that they were in too enfeebled a condition to warrant complication at the time of operation by taking a specimen for biopsy. When a reasonable doubt exists we do not press the claim. Some authors have apparently felt that an X-ray diagnosis was sufficient for a scientific paper. We cannot find one case of inoperable carcinoma of the stomach *proven by biopsy* which has recovered after physio-

therapeutic treatment Many have apparently been benefited for a short time, but all have either not been reported further, or have died

What then is the problem of inoperable carcinoma of the stomach? Is it not to make the inoperable case come under operability by the aid of physiotherapy and to relieve pain, and add a few months to the patient's existence?

Even at the operation of a gastro-enterostomy one hesitates to cut into a malignant growth for a biopsy for fear of spreading metastases Sometimes a gland in the gastrocolic omentum may be removed The X-ray, history, tumor felt through the abdominal wall, vomiting of blood, melena, wasting—all together or separately, are not sufficient for a scientific diagnosis These, together with the direct inspection of the viscus and glands, are many times sufficient, but modern thought requires a microscopical examination before the case can without peradventure be admitted to the class of surely carcinoma, surely cured

Is it a wonder, then, that these patients may go for months under medical treatment before the true nature of the disease is made clear? The best treatment for cancer of the prepyloric area is to teach the medical profession to make an early diagnosis of a really surgical condition Given an early case, surgery gives the best hope of cure Given a moderately advanced case, surgery plus irradiation is indicated, and effects some palliation Given an advanced case, the patient's psychology is sustained by irradiation The pains are sometimes relieved by irradiation, and lesser surgical procedures may be brought in to aid in prolonging life In this class lies the utility of a gastro-enterostomy or jejunostomy under local anæsthesia

In the literature that has been reviewed, there are numerous claims for cure after one kind or another of irradiation Many of these claims have been scrutinized, but have been left out as obviously not substantiated by sufficient proofs, and the proofs presented have not been suitably evaluated One surprising article reports two out of three cases purporting to be stomach cancer well four and a half and seven years after inception of treatment by fractional X-ray, and not even was an inspectional incision made, not to mention a microscopical report! The diagnosis appeared to be based largely on the roentgenogram

In reviewing these articles, it is clear that the scientific background of the various observers differs widely, and we fancy some would not have made their observations public had they been better trained The late diagnosis is a reproach to the medical profession, but the early diagnosis in a series of X-rays for all gastric conditions is exceedingly laudable (Christian)

It is almost vain to speak of the scientific side, that is best placed in the hands of the laboratory worker

In cancer of the stomach, we are dealing with cancer in a much covered organ, where early involvement is so insidious that it is shrouded in a mass of indefinite symptoms, almost no one of which is pathognomonic of the disease in question We do not know the predisposing cause of stomach

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cancer We do not find often the shadow of an early filling defect, and we have but a single organ, wonderfully concealed, to deal with

An analysis of the histories of the 122 cases observed at the Memorial Hospital shows that 82 were males and 39 females The age of the patients is shown in the following table

Number of cases between 20 and 30	3
Number of cases between 31 and 40	9
Number of cases between 41 and 50	28
Number of cases between 51 and 60	45
Number of cases between 61 and 70	32
Number of cases between 71 and 80	5

The oldest patient was 79, and the youngest 25

Of these cases, 92 gave a history of weakness, and 108 of loss of weight The appetite was poor in 61 cases Thirty-one showed anæmia In 81 a definite mass was present, and in 91 a sentinel node Twenty-three cases had pyorrhœa Eleven showed an enlarged liver The physical findings were corroborated by X-ray examination in 90 cases Eighteen showed retention In four there was a positive Wassermann In three, blood was present in the stools The histories revealed that 40 operations were performed, some of which were done previous to the patients coming under our care There were 22 gastrojejunostomies, 8 resections Two pylorotomies were done in the hospital, 4 jejunostomies, and 4 gastrotomies The location of the growth was in the cardiac portion 19 times, in the lesser and greater curvature, 7, in the lesser curvature alone, 20, in the prepyloric region 45 times There were two cases of linitis plastica, and ten of diffuse carcinoma Of these cases, 11 were recurrent Of the treatment they had been subjected to, 18 cases had received 1 X-ray treatment, 21 received 2 X-ray treatments, 7 received 3, 13 received 4, 3 received 5, 3 received 8, and 1 received 18 Twelve cases each received 1 radium treatment, 2 cases received 2 radium treatments, 2 cases received 5 radium treatments, and one case received 10 radium treatments One case had 4 X-ray and 1 radium treatments, one case had 4 X-ray and 5 radium treatments, and another had 3 X-ray and 2 radium treatments Some form of surgical procedure with the implantation of radium emanation in the growth was performed in 8 cases Most of these operations were gastro-enterostomies In making a diagnosis it has been apparent that one must depend more upon the story of the patient than upon the X-ray or physical findings When the physical findings are present the disease has advanced far Christian,* in a recent article says that "Few cases of cancer are unexpectedly revealed by Rontgen-ray examination in patients whose full histories and systematic general physical examinations are recorded" This is a very significant observation coming from one whose authority is so worthy of respect The general appearance of the patient together with a history of weakness and loss of weight is very valuable in coming to a diagnosis Loss of appetite is not always present

* J A M A 1924 vol XXXII p 2011

It is not always possible to corroborate our operative findings by a biopsy, as some patients are too sick to warrant any complication of the operation by increasing it. A simple gastro-enterostomy may be all they will stand, and sometimes only a jejunostomy. In very emaciated cases with gastric retention, a simple jejunostomy may prolong the life for months.

Too much dependence on X-ray diagnosis is to be viewed with caution, and it is better when gastric symptoms of an obscure nature persist over any length of time that the patient be given the benefit of an exploratory inspection. In no other way do I think that the majority of gastric carcinomata can be discovered early enough for cure.

I wish to express my thanks to Drs Douglas Quick and William B Colev for the privilege of including some of their cases in this series, and my appreciation to Dr Ralph Heerden for his thorough cooperation from the standpoint of the roentgenologist and also from the standpoint of the radio-therapist. To Dr Theodore H Allen, an experienced gastro-enterologist, I am indebted for material aid in diagnosis in the Wednesday morning clinics.

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ABDOMINAL PUNCTURE IN THE DIAGNOSIS OF ACUTE INTRAPERITONEAL DISEASE*

By HAROLD NEUHOF, M D

AND

IRA COHEN, M D

of New York, N Y

DESPITE the vast numbers of operations that are performed for acute intraperitoneal disease, improved methods in the pre-operative diagnosis have not been evolved in recent years. As a result, the indications for or against operation are not always clear, the history and the usual physical examination not infrequently fail to establish a positive diagnosis, and the choice for or against an exploratory laparotomy may rest on relatively scant evidence. The exact proportion of cases in which the diagnosis remains in doubt cannot be stated, but in our own experience we would place it between five and fifteen per cent. In some of the cases in this group, the subsequent course proved that laparotomy had not been indicated. In other cases, non-intervention proved to be equally incorrect. Were it solely a matter of scientific imperfection in diagnosis, this situation could be termed merely unsatisfactory, unfortunately, however, errors in diagnosis and indication have occasionally led to unnecessary complications and even to death in some instances. Any safe method that can aid in the diagnosis of acute intraperitoneal disease should therefore be welcome. From our experience we are convinced that abdominal puncture is a safe procedure that is often of invaluable aid in the diagnosis of acute intra-abdominal lesions.

The use that has already been made of abdominal puncture in acute abdominal disease can be briefly sketched for the literature contains only scattered references to the method. In 1906, Solomon¹ devised an ingenious but rather complicated apparatus that he recommended for abdominal puncture. It consists of a needle within a trocar, through which a ureteral catheter is passed into the peritoneal cavity. Solomon described a few cases in which the procedure appeared to be of value. Abdominal puncture to determine an appendiceal abscess is mentioned by Sahli² in his *Manual of Diagnosis*. In 1912, Panichi³ reported the results in two cases, together with an examination of the aspirated fluid and autopsy records. At a meeting of the New York Surgical Society a number of years ago Lilienthal suggested the use of exploratory puncture for the diagnosis of gonococcus or pneumococcus peritonitis. Denzer⁴ devised a trocar with capillary tube for the study of peritoneal fluids in infants, and encountered a few instances

* The material for this paper is derived from the surgical services of Doctors Lilienthal, Elsberg and Moschcowitz at the Mt Sinai Hospital, from the First Surgical Division of Bellevue Hospital, from the authors' services at Montefiore Hospital and their private practice.

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in which peritonitis was unexpectedly disclosed by the use of the instrument. He believed that fluid could be more readily obtained by a capillary tube than by ordinary aspiration. The conclusion that can be drawn from the literature is that abdominal puncture has proved of some diagnostic value in a few scattered cases.

About five years ago we began to use abdominal puncture for diagnosis. Our first efforts were in the direction of establishing a satisfactory technic and of determining the frequency with which fluid would be found on pre-operative puncture when it was proved to be present at operation. Thus, during a short period, abdominal puncture was employed as a routine in most cases of acute peritoneal conditions that came to operation. The punctures were performed under anæsthesia just prior to laparotomy. In the later series of cases, abdominal aspiration was used in those instances in which the diagnosis was uncertain or could not be established by the usual methods of physical examination.

The subject will be taken up as follows: (1) The technic of abdominal puncture. (2) The safety of the method. (3) The significance of negative punctures. (4) Contra-indications. (5) Value of abdominal puncture in diagnosis and prognosis, and in the indications for and contra-indications to operation.

Technic—The method we employ consists of the use of a lumbar puncture needle to which a ten or twenty c.c. syringe fits accurately. The usual preparation of the skin of the abdominal wall is made. Either freezing of the skin with ethyl chloride or anæsthetization of the proposed tract of the needle with novocain is practiced. A small incision in the skin is made for two reasons: first, to avoid carrying bits of skin into the track of the needle, and, secondly, to preserve the delicacy of touch when the needle is introduced. The usual site of election is a point at or below the level of the umbilicus to the right or left of the median line. We have generally punctured through the rectus muscle near its outer border, but puncture can be made lateral to the muscle. The site of puncture can often be placed in the line of the probable laparotomy incision. Of course aspiration will not be performed over the situation of a palpable or questionable mass. Thus if puncture is to be employed in a case of suspected appendicitis abscess with peritonitis, it should be done in the left lower quadrant. After the skin incision, the lumbar puncture needle with stylet in place is introduced perpendicularly with slow even pressure. In puncturing through the rectus muscle the resistance of the anterior sheath is felt. Passing through the muscle a similar resistance of the posterior sheath is encountered and then the needle enters the peritoneal cavity. The stylet is withdrawn and the syringe attached. While suction is being maintained the needle is pointed in various directions. If no fluid is immediately found the vacuum in the syringe should be maintained for a time for we have withdrawn fluid in some instances only after an interval of several seconds. The latter is particularly true when the amount of intra-peritoneal fluid is small. It is of practical importance to note that fluid is

more frequently encountered just beneath the anterior parietal peritoneum than in the depths of the abdominal cavity. Therefore suction should be especially maintained as the needle is withdrawn, in cases in which fluid has not been encountered up to that time. In some instances only a drop of fluid may be withdrawn and may be missed unless sought for in the lumen of the needle or on the surface of the plunger. A dry tap should not be assumed merely because fluid is not at once evident. We wish to emphasize the fact that we have upon a number of occasions obtained the necessary information for a positive diagnosis from a single drop of fluid.

Safety of the Method—Theoretically, a possibility of injury to a loop of gut exists. We are convinced, however, that this is only theoretical in acute abdominal conditions. In the first place this accident has not been seen by us in an experience of more than a hundred cases. The majority of these were subjected to operation and evidence of trauma to the intestine has never been noted. The subsequent course of those not operated upon in no way suggested a visceral injury. Secondly, the use of abdominal puncture for pneumoperitoneum has demonstrated the absence of danger in introducing the needle.⁵ Finally, we have attempted to puncture loops of exposed intestine with a lumbar puncture needle and have been unable to do so unless the gut is held fixed. There may possibly be some danger in the use of a very fine needle, but there is every reason to believe that none exists with the ordinary small-sized lumbar puncture needle. We wish to emphasize here, however, that abdominal puncture is not safe in subacute or chronic intra-abdominal lesions, in which a loop of intestine may be fixed.

Whether the following history can properly be included as an example of injury to a fixed loop of gut is doubtful, but it is reported for the sake of completeness. A middle-aged man was admitted to the hospital with a ten-hour history of generalized abdominal pain. With the onset of pain, a left inguinal hernia of long standing became irreducible. Obstruction, however, was not complete. Because of the very marked generalized abdominal rigidity a peritonitis was suspected and abdominal puncture was done in the left lower quadrant. This proved negative. At operation a sliding hernia of the sigmoid was found, surrounded by purulent exudate. The free peritoneal cavity was not entered. A violent post-operative gas gangrene of the wound and abdominal wall developed. The patient died three days after operation. At the post-mortem examination there was found, in addition to the gas gangrene of the abdominal wall, adherent gangrenous loops of small intestines and sigmoid, with a perforation and peritonitis. It is probable that this was the primary condition and that the irreducible hernia was due to increased intra-abdominal tension. The perforation was not at the site of abdominal puncture. The case is presented because it is the only one in which there existed any possible relation between abdominal puncture and an intestinal lesion.

The Significance of Negative Abdominal Puncture—Before discussing the value of abdominal puncture in diagnosis, the proposition of negative

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punctures in the presence of fluid should be stated. There were negative punctures in the presence of fluid demonstrable at operation in four cases in our series. Therefore with the technic we employ, *a negative puncture does not exclude the presence of fluid*. Thus in a case in which a peritonitis is suspected a negative puncture in no way justifies the elimination of that diagnosis. On the other hand, a negative puncture in cases of peritonitis in which the pneumococcus or gonococcus is suspected, may be of some value. In such instances, with the diagnosis in doubt, operation would probably be performed, whereas it would not be carried out if the puncture were positive and revealed either of these organisms. There have been some instances in which a negative puncture has supported the clinical impression of absence of an intraperitoneal lesion and to this extent has been of value. For example, in a recent case the wheel of a wagon ran over the left lower chest of a boy. He was in moderate shock, the pulse-rate was elevated, the upper abdominal wall tense. There was not enough evidence to warrant the diagnosis of an intra-abdominal lesion (rupture of the spleen), and the case was considered one for observation unless the abdominal puncture was positive. The puncture was negative, and the further course demonstrated that no gross intraperitoneal lesion had existed. In general, however, a negative puncture is of no diagnostic significance. We cannot stress too strongly the necessity for a clear appreciation of the meaning of a negative puncture. *If in any given case the decision has been reached that operation is indicated whether for a traumatic or an inflammatory intraperitoneal lesion, operation should be proceeded with absolutely regardless of a negative puncture*. It is a positive puncture under such circumstances that might lead to non-operative treatment, never a negative puncture. Unless this viewpoint is clearly kept in mind, operation might be withheld in cases in which it is indicated.

Contra-indications to Abdominal Puncture—The first obvious contra-indication to abdominal puncture exists when the diagnosis or the clinical indication is sufficiently clear without it. The only other contra-indication has already been pointed out, namely a chronic or subacute intraperitoneal lesion (neoplasm, tuberculosis or other chronic inflammation) that may fix a loop of intestine. When a mass is present in an acute peritoneal infection puncture should not be performed in that region because of the danger of injuring a fixed loop of intestine.

The diagnostic value of abdominal puncture consists first, in the demonstration of the existence of fluid, whether blood, serous effusion or pus, and secondly in making possible examination of the fluid that is withdrawn. Other than blood or bloody fluid obtained in traumatic cases both the macro- and microscopic characteristics must be evaluated. For example it is the organism found in the microscopic examination of spreads of the aspirated fluid that establishes the diagnosis of a pneumococcus or a streptococcus peritonitis. In a case of rupture of the bladder the urinous odor of the fluid obtained by puncture gave the clue. In acute pancreatitis we have found that the fluid sometimes has a typical beef juice color and oily appearance.

In four cases of verified pancreatitis the fluid was characterized by a high content of polymorphonuclear leucocytes (85 to 90 per cent) and at the same time an absence of bacteria in the spreads. A yellow fluid with sour odor aided in establishing the diagnosis of a perforated gastric ulcer in one instance. Enough has been said to indicate that the diagnostic value of a positive puncture in general depends at least as much upon a study of the fluid as upon merely obtaining fluid.

The proven diagnostic value of the method in our hands is best illustrated by taking up the different groups of cases in which it has been employed. Albert convenient, this is a somewhat artificial manner of treating the subject, because in not a few instances the group into which a case fell was only determined by the abdominal puncture.

The *traumatic group* of cases will be first considered, and some illustrative cases presented. Abdominal puncture was of diagnostic value in a number of instances. In a case of stab wound of the left flank, seen shortly after the accident, there was very slight evidence of an intraperitoneal lesion. Blood was obtained by abdominal puncture and this finding was the determining factor in the decision to operate. A penetrating wound of the descending colon was found. Of four cases of rupture of the spleen, operation in one was performed chiefly because blood was withdrawn on puncture. This patient was seen within two hours of the accident and presented only vague clinical evidence of an intra-abdominal lesion at the time. In another case the clinical picture was interpreted as one of an inflammatory focus in the left upper abdomen.

The boy entered the hospital two days after having fallen against the curb, striking his left lower chest. His temperature was 102.6, there was rigidity and a rebound sign throughout the abdomen, most marked in the left upper quadrant. The white blood count was 22,000, with a differential count of 84 per cent of polymorphonuclear cells. A rupture of the spleen was not considered in the diagnosis. Puncture of the general peritoneal cavity was negative, but aspiration of the left subphrenic region disclosed blood. A rupture of the spleen with perisplenic hematoma was found at operation, no blood being present in the free peritoneal cavity.

In a case of injury to the right lower chest with very questionable evidence of a lesion of the liver, blood found at puncture led to an exploratory laparotomy. A superficial tear of the liver surface was found, from which the bleeding had ceased at the time of operation. This is the only case in which a positive abdominal puncture, although verified at operation, led to an unnecessary laparotomy.

In the following case the evidence favored an intrathoracic lesion.

Bullet wound with entrance just below cardiac apex, X-ray showing the bullet lodged high up in right lobe of liver or in lower lobe of right lung. The opinion of the radiologist was that the peritoneal cavity was not penetrated. The abdominal wall was rigid, however, and an intraperitoneal lesion was suspected. There was blood on abdominal puncture, at operation, penetration of the diaphragm and liver and a large amount of blood in the peritoneal cavity were encountered.

Another interesting example was a case of fracture of the pelvis in a patient with peritonic manifestations. Catheterization disclosed urine free

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from blood. The diagnosis therefore was a probable retroperitoneal hemorrhage. However, fluid with a urinous odor was obtained by abdominal puncture. Therefore operation was performed despite the negative urine found by catheterization. An intraperitoneal rupture of the bladder was found at operation, the tear being at the fundus.

Turning now to the group of *peritonitis* cases, there was a surprising number of instances in which positive abdominal puncture was of decisive value not only in the diagnosis, but also in the prognosis. The first group is that of *pneumococcus peritonitis*, all in children. The value of puncture in the diagnosis of this disease is so evident, that we need only refer briefly to it here. There have been ten or more cases under our observation in the past five years. In some the diagnosis was probable without puncture, in others, doubtful. In two or possibly three, the diagnosis was acute appendicitis, and in these the result of puncture led to the correct treatment—namely, to withhold operation. It would be out of place to discuss here the surgery of pneumococcus peritonitis, but an illustrative case will demonstrate the value of puncture in the diagnosis and in the indication for treatment. A girl presented the picture of a probable pneumococcus peritonitis. Abdominal aspiration revealed pus containing the organisms. Under observation the process localized, a large pneumococcus abscess was drained, and the patient recovered.

The next group of cases is that of *streptococcus peritonitis*. There were several cases in this group, chiefly in children, in which the diagnosis of the nature of the peritonitis was in doubt until cleared up by abdominal puncture. It is safe to say that nearly all of them would have been subjected to an unnecessary laparotomy with a tentative diagnosis of acute appendicitis with peritonitis if puncture had not been employed. It is, of course, possible for a pure streptococcus peritonitis to be secondary to an infective focus that is remediable by operation, but in the gravely ill, septic patients who have come under our observation and have died, autopsy has invariably demonstrated that the streptococcus peritonitis was part of a general sepsis and was not derived from an intraperitoneal pus focus. In two striking cases the saving of life can be largely ascribed to the disclosure of a streptococcus peritonitis by puncture and the consequent withholding of operation.

A child was admitted in a septic state, with an acutely inflamed throat and the clinical picture of a peritonitis. The admission diagnosis was acute appendicitis. It was evident that even a simple laparotomy would be very poorly withstood by the child in its desperately toxic state. The turbid fluid obtained by abdominal puncture revealed chains of streptococci in the stained spreads. Conservative treatment was instituted. For several days the septic state continued, the blood culture was positive, but the abdominal manifestations gradually cleared up. A pneumonia developed, followed by an empyema that was drained, and the child recovered.

The second case was perhaps more remarkable.

A girl of ten presented the clinical picture of an acute virulent peritonitis in which the diagnosis of acute appendicitis had been made. The abdominal condition had apparently followed a sore throat. Her condition was desperate and the only justification

for a laparotomy would have been a reasonable assurance of the existence of an appendicitis. By abdominal puncture, cloudy fluid containing streptococci was withdrawn. Treatment of the septic state was instituted. Blood culture proved positive. After several days, drainage of a localized intraperitoneal collection of pus was performed, metastatic abscesses in various parts of the body—tibia, ankle-joint, pleura, etc.—were drained, and the patient recovered.

The importance we attach to the finding of streptococci alone in the smear of aspirated fluid, and the contra-indication to operation in doubtful cases, based on such a finding, is supported by a study of the culture of peritoneal fluids. Through the courtesy of Dr F. S. Mandlebaum we looked up the records of such cultures over a period of three years at Mount Sinai Hospital, during which time there were more than 200 that were studied. Just twice was a pure culture of streptococcus obtained in acute appendicitis. These may not be the only instances in which the streptococcus was the sole organism, for cultures are not taken at all operations. From this report and from our own experiences, however, our conclusion is that a case of appendicitis clinically so obscure as to call for puncture and in which streptococci alone are to be found in spreads of the fluid obtained must be a very rare combination. As in any other diagnostic procedure, abdominal puncture is but part of the composite picture, but where it is called upon as an aid, the finding of streptococci has in our hands been a signal to withhold operation. This conclusion has been supported by our results in which non-operative treatment, in the early stages of a streptococcus peritonitis at any rate, has unquestionably resulted in the saving of life in several instances.

Turning to a group of seven cases of *acute pancreatitis*, abdominal puncture proved of great value in all but one. These patients came under observation with the clinical picture of acute or subacute intestinal obstruction with some signs pointing to a peritonitis. Although acute pancreatitis was suspected in some, the disclosure of fluid having the characteristics that have already been mentioned clinched the diagnosis. In one patient who would have ill withstood an exploratory laparotomy, the result of abdominal puncture was of decisive aid in the decision to defer operation.

This was a thick-set man with a greatly distended abdomen and a short history of intestinal obstruction. His circulation was collapsed, his skin cyanotic. Although the diagnosis of an acute pancreatitis was entertained, an acute cholecystitis or an intestinal obstruction could not be excluded. Abdominal puncture disclosed fluid resembling beef juice containing 87 per cent polymorphonuclear leucocytes but no bacteria. Under conservative treatment the fulminating abdominal manifestations gradually subsided, fulness and oedema developed in the left lateral abdominal region. On the eighth day after admission an extraperitoneal incision was made and a peri-pancreatic abscess, with a cavity lined by necrotic fat and containing sloughs of pancreas, was drained. The patient made a slow recovery, with discharge of pancreatic sloughs from the wound.

The one case of proven acute pancreatitis in which abdominal puncture did not reveal the typical fluid should be mentioned, although the existence of a non-bacterial peritonitis was demonstrated. A stout elderly woman came under observation with the picture of an intestinal obstruction, and pneumonia of both lower lobes (verified by X-ray). In the diagnosis acute cholecystitis and acute pancreatitis were considered. Puncture on the right side of the abdomen was negative. The next day puncture to the left

ABDOMINAL PUNCTURE IN DIAGNOSIS

of the umbilicus revealed thin pus containing 95 per cent polymorphonuclear leucocytes, but no bacteria in the spreads. The fluid did not present the appearance we consider typical of the peritoneal exudate in acute pancreatitis. At operation, under local anaesthesia, an incision in the right upper quadrant was made, fat necrosis characteristic of pancreatitis was found, but no purulent fluid was encountered. A cholecystostomy was performed, the left side of the abdominal cavity was not explored. It must be assumed that the purulent fluid was encapsulated on the left side, the subsequent course of the case indicated a spontaneous disappearance of this exudate.

Unless the peritoneal exudate is the only, beef juice like fluid typical of cases of pancreatitis, all that can be said of the finding of preponderating polymorphonuclear cells and no bacteria in an abdominal puncture fluid, is that the patient is suffering from an aseptic peritonitis. If this fits in with a clinical picture of pancreatitis the diagnosis is justified. However, in the following case, we were misled in our interpretation.

A woman suffering from diabetes presented the clinical picture of an acute incomplete intestinal obstruction with pain and tenderness over the left lateral abdominal region. During several days' observation the conclusion was reached that the lesion was an acute pancreatitis. Abdominal puncture disclosed cloudy fluid containing 80 per cent polymorphonuclears but no bacteria. The symptoms persisted and at operation there was found a carcinoma of the colon with incomplete intestinal obstruction and secondary peritoneal exudate.

Clinically the above instances are a borderline between the group in which the diagnosis of a peritonitis is clear and the group in which that diagnosis cannot justifiably be made by the usual physical examination. In the past five years we have seen several cases belonging to the latter group. It is noteworthy that in these cases abdominal puncture was of decisive value. Two striking instances will serve as illustrations.

In the first a colored woman was admitted with a history of frequent vomiting and high fever. She was delirious and it was impossible to make a satisfactory physical examination. Abdominal puncture disclosed considerable cloudy fluid containing streptococci. Operation was not performed. The septic state rapidly grew worse and the patient died the same day. The autopsy revealed a phlegmonous gastritis and a generalized streptococcus peritonitis.

The second case was a man, fifty-seven years old, with a history of acute abdominal pain preceded by sore throat, and the presence of pronounced icterus. The provisional diagnosis was acute pancreatitis, although the history of sore throat raised the question of a metastatic peritonitis. The abdominal puncture fluid contained polymorphonuclear cells and streptococci. The patient died of streptococcus peritonitis. At autopsy the source of the infection was not found.

A diagnostic value of abdominal puncture to which we have not as yet referred exists in some cases in which the diagnosis of a peritonitis can be readily made and the indications for operation are clear, but in which the nature of the lesion is obscure. In a number of instances the character of the fluid obtained by aspiration has aided in clearing up the diagnosis and has thus enabled us properly to place the abdominal incision. As an example we may cite a case in which the diagnosis was acute appendicitis and spreading peritonitis. Abdominal puncture under anaesthesia disclosed fluid character-

istic of a perforated gastric ulcer, this was the lesion found upon opening the abdomen in the right upper quadrant

Finally, there are many acute intraperitoneal lesions in which we have not had the opportunity to test the diagnostic value of abdominal puncture. It is logical to believe that in such conditions as perforations of hollow viscera (in which air might be obtained by puncture), ruptured ectopic gestation, or twisted ovarian cyst, abdominal puncture will prove of as much diagnostic value as in the intra-abdominal lesions in which we have employed the method

SUMMARY

1 Exploratory abdominal puncture is a simple, safe, and valuable aid in the diagnosis of obscure acute intra-abdominal disease

2 It serves to establish the diagnosis of a traumatic or inflammatory intraperitoneal lesion in some cases in which the diagnosis cannot otherwise be made

3 In other instances abdominal puncture offers conclusive information as to the source and nature of a peritonitis, and thus aids directly in arriving at the therapeutic indication as well as the prognosis

4 In the peritonitis group abdominal puncture is of especial value in establishing the diagnosis of the pneumococcus and streptococcus infections

5 Abdominal puncture is contra-indicated in any subacute or chronic intra-abdominal disease in which a loop of intestine may be fixed

6 A negative abdominal puncture does not exclude the presence of fluid and should therefore never be interpreted as a contra-indication to operation in suspected peritonitis or traumatic visceral lesions

7 Abdominal puncture should be employed as an aid to diagnosis in every obscure acute intraperitoneal lesion for which operation may be indicated

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LOCAL VERSUS GENERAL ANÆSTHESIA FOR UPPER ABDOMINAL OPERATIONS*

A COMPARISON OF POST-OPERATIVE CONDITIONS

By J. TATE MASON, M.D.

OF SEATTLE, WASH.

As a basis for this paper 100 consecutive upper abdominal operations have been studied. Fifty of these were performed under ether and fifty under local, or local and gas anæsthesia. That the information regarding this group of cases might be obtained with the greatest possible accuracy, a group was selected from within a twelve-month period. All operations were performed by one surgeon, in the same hospital, with practically no changes in the surgical staff or the floor nurses.

Local anæsthesia, as compared with anæsthesia by general narcosis, has proved in our experience to possess advantages of cardinal importance. Notwithstanding the relatively low mortality from ether and chloroform anæsthesia, the damage done to kidney, liver, and lung tissue by general narcosis as compared with the effects on these organs by local injections, is considerable. Since the institution of relatively non-toxic drugs, novocaine, procain, etc., in local anæsthetic work, degenerative changes in parenchymatous organs are negligible, and pneumonia, bronchitis, nausea, vomiting, and shock are conspicuous by their absence in the post-operative period. At a time when the vital forces are most called upon, when the strength is at lowest ebb, ether anæsthesia tends to reduce still further those forces. Prolonged vomiting causes dehydration, and acidosis results.

General anæsthesia was induced by the inhalation of nitrous oxide and oxygen and continued with ether given by the open or drop method, using an Esmarch inhaler. The local anæsthesias were induced by infiltration of the anterior abdominal wall, followed by anterior splanchnic block. The solution used was a 0.5 per cent solution of procain in 0.6 per cent sodium chloride, with 9 drops of adrenalin chloride added to each 100 c.c.

In the local anæsthesia cases there were a number of factors which we soon found had to be considered, in addition to the administration of the anæsthetic solution to the nerves supplying the region to be operated upon.

Our first observation was that individual sensibility to pain plays a more important part in a successful local anæsthetic than had been expected. Patients who have a considerable layer of fat are hard to anæsthetize completely. In patients with acutely inflamed gall-bladders who have had local peritonitis in the upper right quadrant, the skin has been found hypersensitive.

Apprehension probably is the greatest factor in a patient's response to painful stimuli. Women are more sensitive than men, while babies, old people

* Read before the Western Surgical Association, December 17, 1925.

and some individuals, as men who live out of doors, are less sensitive to pain than others

A patient who reaches the operating room with the greatest degree of confidence and calmness is much more likely to permit an operation under local anæsthesia to be carried through to a successful conclusion. If the patient is nervous and partially exhausted the conditions for local anæsthesia are extremely unfavorable. Rest, sleep, a high glycogen reserve, and a narcotic administered one hour before operation, are valuable in securing this desirable condition of calmness and euphoria.

For the rest, these patients entered the hospital early in the afternoon of the day before operation, so that at least four hours of rest might be obtained. To insure a high glycogen reserve a light supper was given at 5 P M, and later, between 9 and 9 30 a tray containing four crackers, three ounces of strained honey, and one glass of milk to which had been added a teaspoonful of lactose and 10 grains of veronal, was taken to the patient with instructions to take at once. This increases the glycogen reserve, adds 650 calories of food with very little residue, and furnishes a mild somnifacient which in most cases we found lasted over the greater part of the night.

Morphine and scopolamine modify to a large degree the sensibility to pain. We believe it is 10 per cent more efficient when given hypodermically in a solution of magnesium sulphate. It establishes favorable conditions for the necessary manipulations of the anæsthetic procedure. It does away with the extreme apprehension some of these patients have. We have not seen any harmful effects from the administration of 1/6 grain of morphine and 1/150 of scopolamine. Up to the present this dose has been given in the Clinic over three thousand times, without a single unpleasant experience.

The patients reach the surgery in a very comfortable frame of mind. We feel that it has been helpful to have them met there by a girl with a pleasing personality. With a reassuring word she makes them comfortable on the operating table, and if possible, diverts their attention from the operation.

We have found it a great mistake to ask the patients if they are being hurt—and still another error has been to do anything that causes discomfort without telling them beforehand. For a time we put small pledgets of cotton in the patients' ears to prevent their hearing the necessary noises and conversation around the operating table. This routine has been abandoned because some patients who were resting comfortably before became nervous and excited as soon as they realized that something had been done to prevent their hearing acutely.

In a comparison of 40 cholecystectomies in which 20 were done under local anæsthesia, we found these interesting facts. Practically no more time was required for operation under local than under general anæsthesia. Practically the same total quantity of morphine was used after operation. Fifteen of the 20 ether cases vomited and most of them for a period of two or three days, whereas only 8 of the 20 local cases vomited at all, and these with one or two exceptions for but one day. The post-operative stay in the hospital

ANÆSTHESIA FOR UPPER ABDOMINAL OPERATIONS

averaged four days less for those patients whose operations were under local anæsthesia. Gas pains were less frequent and less severe in the local cases.

In 40 gastro-enterostomies in which 20 were performed under local anæsthesia, an average of only six minutes longer was required for local than for ether operations. Gas pains and vomiting were more frequent and more persistent after ether. Practically no difference was present in the quantity of morphine used after operation.

A comparison of the total number studied, 100 upper abdominal operations, with 50 performed under local, showed the following points of interest. An average of only eight minutes more was required for each operation under local than for each of the 50 under ether anæsthesia. The average temperature for the first week after operation was below 99 degrees F in local cases and above 99 degrees F in ether ones. The average stay in the hospital after operation was three days less for the cases under local anæsthesia. Of the local anæsthetic patients only 18 vomited, while 33 of the ether patients vomited. Also, in the latter vomiting was more marked and more persistent. Only 19 of those having a local anæsthetic against 30 of the ether patients suffered gas pains.

Severe shock was experienced only once in this series, and mild shock four times. This occurred each time after ether anæsthesia. There was no surgical shock after anæsthesia by local injections. Bronchitis was met with in 11 patients taking ether and in 3 after local anæsthesia. There was one pneumonia case. This patient, who was fifty-nine years old, had an acute gall-bladder and bilateral pyelitis. Operation was under local anæsthesia and was successful from the operative standpoint. The patient died eight days after operation—the only death of this series. There was no hæmia or phlebitis.

Statistics are very apt to be misleading, and many of us are rather skeptical when it comes to accepting them whole-heartedly. With this knowledge in mind we asked the supervising nurses in whose care these patients have been to express their candid opinions concerning the post-operative condition of abdominal cases done under local injections, as compared with those performed under ether anæsthesia. They have been unanimous in their expressions of favor for local anæsthesia, and have emphasized the marked contrast between the two sets of patients, as a whole.

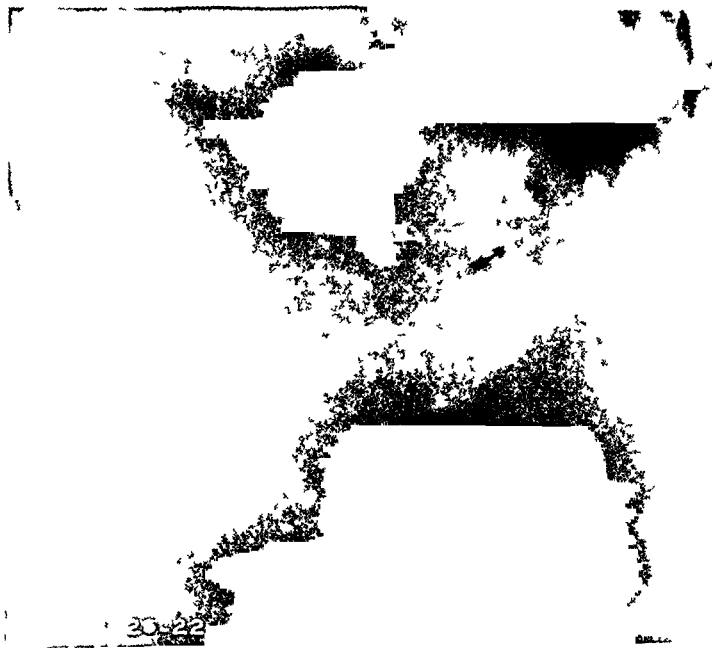
Essentially their impressions were as follows. The patient's general condition following operation done under anæsthesia by local injections was much nearer the normal state than after ether anæsthesia. There was considerably less nausea and vomiting, his morale was higher, and convalescence was greatly shortened. Further, the family and close friends of the patient were relieved of much anxiety, and there were no long days of waiting while the patient suffered from violent nausea, vomiting, or shock, appearing to the family as if he might die at any minute.

PENETRATING GASTRIC ULCER, SITUATED NEAR THE CARDIA VISUALIZATION OF THE CARDIA*

By RICHARD LEWISOHN, M D
OF NEW YORK, N Y

A MAN, fifty-four years old, was admitted to Mount Sinai Hospital in 1922, with a three months' history of epigastric distress without vomiting. Skiagraph showed a large penetration at the lesser curvature of the stomach in close proximity to the cardia. The X-ray department considered this ulcer as carcinomatous, on account of the large size of the crater (Fig 1). Ewald free HCl 30, total acidity 55.

The operation revealed a firm, irregular mass with a large crater situated near the cardia. Many small glands (size of a split pea) were seen on the omentum. One of



these was removed for microscopical examination. The gastric mass thought to be carcinoma was considered inoperable on account of its size and position. Closure of abdomen in layers.

Microscopical examination of the gland failed to show evidence of carcinoma.

This patient, during the course of three years, was observed in our return clinic. Instead of running the usual course of an inoperable gastric carcinoma, his gastric symptoms gradually disappeared and his general condition improved.

FIG 1—1922 Large penetrating gastric ulcers situated near the cardia.

X-ray pictures taken in 1923, 1924 and 1925 by Doctor Goldfarb (Figs 2, 3, and 4) demonstrate a gradual disappearance of the niche. The post-operative course shows conclusively that the diagnosis of carcinoma was erroneous and that we were dealing with a simple ulcer of the stomach.

This patient presented some interesting features both from the medical and surgical point of view. Crohn has shown that some ulcers have a life-cycle. They can grow to large proportions and gradually diminish in size until they practically disappear. In their dormant stage they may represent a small scar. At a later date they may flare up again and re-assume their original size. Patients of this group have been presented repeatedly as cures following medical or surgical treatment. If this patient had been subjected to a Sippy diet or to a gastro-enterostomy, the excellent result would have been ascribed to the therapy, either medical or surgical. The result would have been the

* Paper read and patient presented before the New York Surgical Society, November 25, 1925.

VISUALIZATION OF THE CARDIA

same, not on account but in spite of the treatment. While this patient cannot be definitely considered as permanently cured, his present condition is excellent.

Interest attaches to the X-ray pictures (Figs 1, 2, 3, 4, 5, and 6) which were made in order to visualize the cardia. The usual gastric plate shows the outline of the stomach, but fails to show the exact location of the cardia. The entrance of the œsophagus into the stomach varies considerably, sometimes the cardia is situated very high, in other cases it enters fairly low down. This variation assumes considerable practical importance, when we are confronted with the question whether an ulcer situated near the cardia is amenable to subtotal gastrectomy.

The visualization of the cardia has interested me for a number of years. I discussed this subject before the New York Surgical Society two years ago, when I demonstrated some plates where the cardia had been visual-

ized by a thin feeding tube in combination with a ureteral X-ray bougie (*ANNALS OF SURGERY*, 1924, vol LXXIX, p 143). Later I replaced the bougie by a wire-spinal. The pictures were not clear, as the gagging of the patient prevented a clear outline of the cardia.

Recently I saw quite accidentally some pictures of carcinoma of the cardia taken by Doctor Goldfarb, which demonstrated very clearly the location of the cardia. In these cases a thick mixture of barium was used. After consultation, with Doctor Goldfarb, we decided to combine the two procedures. The patient receives the usual barium mixture in order to outline the stomach and demonstrate the ulcer on the lesser curvature. Immediately before taking the picture the patient swallows the thick mixture. Thus both the ulcer and the location of the cardia are shown on the same plate. While in the plates shown (Figs 5 and 6) the ulcer was evidently at the place of predilection (reentrant angle) and therefore did not require a pre-operative demonstration of the cardia, this procedure might have been applied advantageously in the patient now described.



FIG 2—1923 Ulcer markedly diminished in size. Note incisura opposite ulcer.



FIG 3 —1924 Ulcer has practically disappeared No incisura opposite ulcer

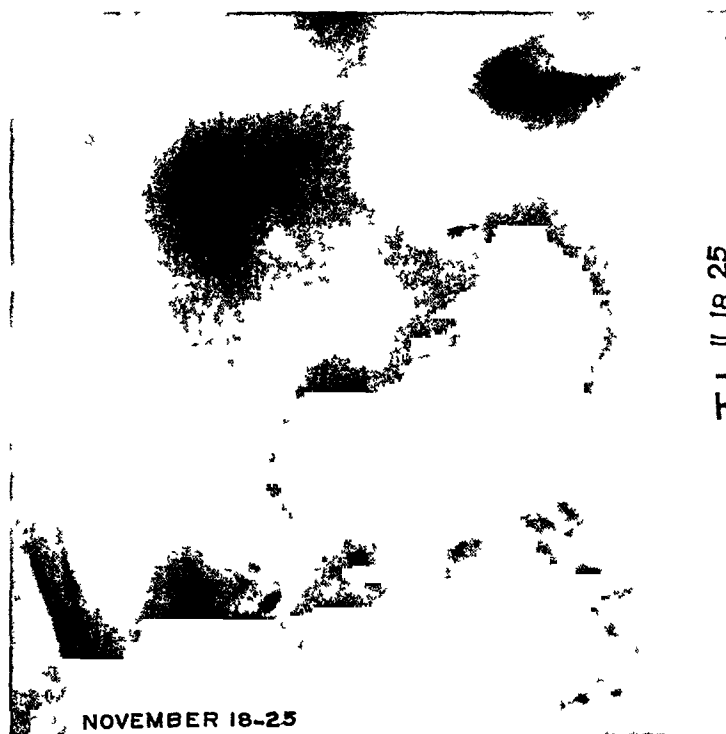


FIG 4 —1925 Small pin-point elevation on the lesser curvature shows location of former large crater-ulcer

VISUALIZATION OF THE CARDIA

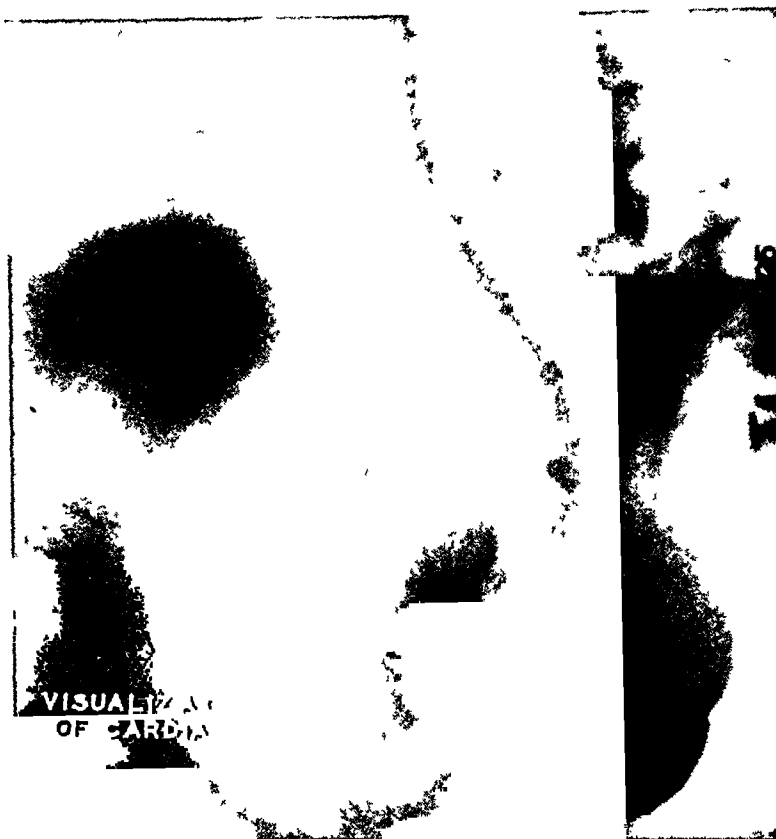


FIG 5—Visualization of the cardia Patient R K Penetrating gastric ulcer

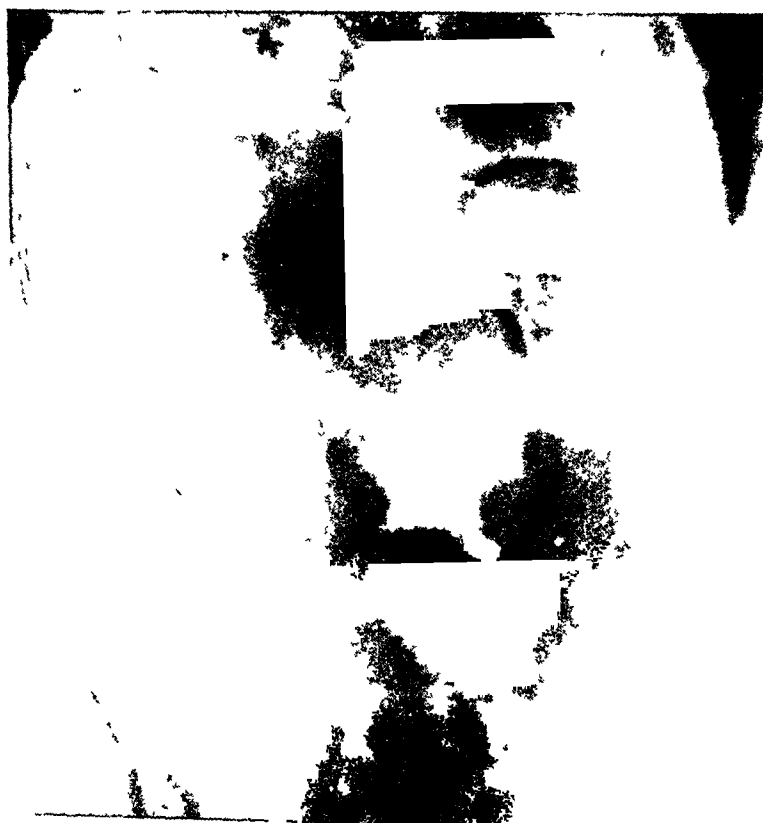


FIG 6—Visualization of the cardia Patient, F L Penetrating gastric ulcer

PEPTIC ULCER OF MECKEL'S DIVERTICULUM

By E STULZ, M D

AND

P WORINGER, M D

OF STRASBOURG, FRANCE

FROM THE CLINIQUE CHIRURGICALE A DE LA FACULTE DE MEDECINE DE STRASBOURG,

DIRECTOR PROF. RENÉ LEFRICHE

MECKEL'S diverticulum is often the cause of serious abdominal trouble. Intestinal obstruction and diverticulitis occur rather frequently and are well known. The development of peptic ulcer in a diverticulum would appear not to be generally recognized. We think that this pathologic condition is not so exceptional, since two well individualized cases came to be observed by one of us in the course of three years. Bibliographic researches enabled us to find only twelve cases, but we ask ourselves whether a great number of "diverticulitis perforans" records are not in fact perforated peptic ulcers.

In this paper we propose to give first a brief outline of our personal cases, that stand for two well-defined types of peptic ulcer of the diverticulum, then to give an outline of the clinical aspect of the disease as founded on the critical study of the records given up to now, and to conclude with the discussion of its diagnosis, pathogeny and treatment.

CASE I.—Boy, four years old, without any pathological past, suddenly feels, after having coughed for two or three days, severe pain in the abdomen with vomiting and intestinal hemorrhage. Sanguinolent stools are abundantly evacuated several times in the day. Besides blackish masses there is a discharge of red blood issuing seemingly from the terminal part of the intestine. The practitioner, who sees the child, diagnoses dysenteric enteritis and prescribes dietetic treatment.

Intestinal hemorrhage persists with the same intensity for a whole week. The child grows anæmic, complains sometimes of abdominal pain, but its general condition gives no cause for anxiety. On the seventh day things change suddenly for the worse, temperature, normal up to now, rises to about 39° C, the child complains of severe pain in the abdomen, begins to vomit, passes neither stools nor flatus from the bowel.

We examine the little patient for the first time on the eighth day after the onset of the symptoms, he is very anæmic and exhibits all the signs of generalized peritonitis. His abdomen shows slight distention and defense musculaire, no resistance in the right lower side of the abdomen nor intussusception-tumor is palpated. Rectal examination shows nothing abnormal, the finger is smeared with dark-reddish blood.

Notwithstanding the absence of tumor "en boudin," even under general anæsthesia we think intestinal intussusception possible, although the profuse hemorrhage preceding by eight days the appearance of peritonitis reminds us at once of the case of perforated peptic ulcer of Meckel's diverticulum seen by one of us with Professor Rohmer¹ three years ago.

On the day of his admission to the pediatric clinic the child is operated upon in order to find the source of hemorrhage and peritonitis. Under ether-anæsthesia the abdomen is opened by a small median sub-umbilical incision, there is some free cloudy fluid, the visible parts of the small intestine are injected and partially covered with fibrinous exudate. They contain no blood.

PEPTIC ULCER OF MECKEL'S DIVERTICULUM

Whilst looking for the appendix we fall upon a loop of the ileum, slightly distended, whose blackish contents can easily be discerned and are evidently blood. On drawing out this loop there is perceived a Meckel's diverticulum as large as an adult's thumb with a perforation on its base. The intestine situated above the insertion of this diverticulum contains no blood. After drying the peritoneal cavity the eventrated loop bearing the diverticulum is fixed to the parietal peritoneum with some stitches. Ligation of the mesenteric vessels leading to the base of the diverticulum closes the operation.

Inspection of the eventrated intestine shows an elongated, almost fissural perforation, half a centimetre in length, situated on the bifurcation of the intestine and the diverticulum, whose walls are very thickened and indurated at this spot. The aperture gives issue to a bilious fluid, its borders are clean-cut, in its neighborhood the serosa is covered with pseudomembranes.

Forty-eight hours after this minima operation the diverticulum is gangrenous, by snipping it off with the scissors one obtains a wide enterostomy.

For a few days the child has no fever, then signs of peritonitis reappear. Some purulent peritoneal sacs are opened, but, notwithstanding repeated transfusions of maternal blood, the patient grows weaker and dies seventeen days after the operation.

In this case we conclude that there existed a peptic ulcer of the Meckel's diverticulum, situated at the base of the vestige, it had existed for some months at least, as shown by the thickening and induration of the mucosa. This ulcer did not cause any symptom up to the moment when it determined an abundant intestinal hemorrhage lasting more than a week. Seven days after the beginning of the hemorrhage the ulcer perforated into the free peritoneal cavity and produced diffuse peritonitis. The histological study of the diverticulum could not be made in this case.

Our second case came under the observation of one of us with Professor Rohmer¹ in 1922.

CASE II—Boy born prematurely (three weeks), showing normal development at first, at five months passes first red blood from the bowel, has black stools for two days, after which lapse of time everything gets normal again. These hemorrhages are repeated five times up to the age of eleven months, when the child is admitted to the clinic. The parents have the impression that the hemorrhages are accompanied by severe colics.

On first examination in the ward the child seems to be in good general condition but is very pale, his mucous membranes are completely colorless, the skin has a waxy appearance, the extremities are cold, somewhat cyanosed. The blood-count reveals 25 per cent hæmoglobin, 2,400,000 red cells, normal proportion of white cells. The spleen is not enlarged. Von Pirquet and Wassermann tests are negative.

The abdomen is normal on palpation, shows no tenderness on pressure.

After several days the child begins to vomit and to refuse food. Stools become liquid but do not contain blood. Temperature remains normal with the exception of a solitary rise to 39.5° C. Finally the child gets apathetic and dies in a state of general debility twelve days after being brought to the clinic.

The necropsy reveals the existence of a small Meckel's diverticulum as big as a child's thumb, fixed by a fibrous cord to the peritoneum in the right paravesical region. The diverticulum is incased in a small encysted peritoneal abscess. Adhesions and fibrinous exudates partition it off completely from the general peritoneal cavity which contains no free fluid. On removing these adhesions there issue some drops of a thickish and viscous liquid. On opening the diverticulum one finds at the precise spot where the diverticular mucosa touches the intestinal, a small, deeply excavated ulcer with clean-cut borders. The intestinal and diverticular walls surrounding the ulcer are indurated, show thickening and hyperæmia. The ulcer has burrowed deeply into the subperitoneal tissues. The histological examination could not be made.

This child was affected with an ulcer of Meckel's diverticulum since it was five months old, at which age the first hemorrhage occurred. In the course of six

months six important hemorrhages reduce the child to a state of extreme anemia. It dies from weakness and infection, unable to resist an encysted peritonitis.

In this case there was perforation, but parietal adhesions kept the peritonitis from generalizing, these adhesions explain why the child could live on for a rather long time after the onset of the symptoms.

Cases Observed Prior to Ours—The oldest record we have been able to find is that of Zimmermann² (Strasbourg) in 1903, boy, five years old, has suddenly abundant intestinal hemorrhages followed by symptoms of peritonitis and ileus, he is operated on the sixth day and peridiverticular abscess is opened. The child dies, diffuse peritonitis. The case, in which every pathological examination is wanting, has been considered by the author as a diverticulitis with perforation but the fact that hemorrhages preceded the peritoneal symptoms makes us believe that there was a perforated peptic ulcer.

The case of Hilgenreier³ (1903) concerns a young man of eighteen who ever since his childhood sometimes had blood in his stools. At fourteen he had very serious melæna. For the two months preceding the operation he frequently passes blood from the bowel and complains of pain in the right para-umbilical region. At the operation there is found a Meckel's diverticulum adhering to the abdominal wall in the umbilical region. A chronic ulcer stretches far down into the abdominal wall. Patient recovers after operation, consisting in resection of diverticulum. The histological examination, and especially the woodcut illustrating the paper, prove that the case was one of chronic peptic ulcer.

A somewhat similar case is that of Dectz⁴ (1908) boy of nine, with diffuse peritonitis following perforation of a diverticulum of the small intestine. The diverticulum was coated with gastric mucosa, but the author cannot positively state that there was in his case perforation of peptic ulcer.

In 1913, Hubschmann⁵ published a case very similar to ours, it is the princeps record which allowed for the first time to establish the clinical syndrome of peptic ulcer of the diverticulum. A boy four and a half years old, has consecutively to a slight abdominal traumatism abundant intestinal hemorrhages for four weeks. Operation is made for suddenly manifested diffuse peritonitis. The child dies and the necropsy shows an ulcer of the base of diverticulum perforated into the free peritoneal cavity. Microscopical examination shows a diverticulum entirely coated with gastric mucosa at whose margin the ulcer was found.

The case of Jackson⁶ (1915) concerns a boy ten years old, who had repeated severe intestinal hemorrhages. In the year preceding his admission to the hospital the child had suffered four attacks of excruciating abdominal pain with vomiting, but without melæna. On performing intra-abdominal exploration there is found an indurated and inflamed Meckel's diverticulum whose suppression by intestinal resection is followed by recovery. At the base of the diverticulum, at the line of union of two mucosæ of different aspect, there is seen a deep ulcer, "in appearance it resembled an indurated duodenal ulcer." The serosa of the diverticulum even shows a star-shaped cicatrix in the spot of the ulcer. A small artery whose lumen is perceived on the border of the ulcer, furnishes the explanation of the hemorrhages. Without any histological examination and evidence Jackson assumes a tuberculous ulcer. We rather believe that his first thought, his comparison of the lesion with a chronic duodenal ulcer, is more correct, and the illustrations of his paper have convinced us of the peptic nature of the ulcer.

Gramen's⁷ case (1915) is the only one where there were no hemorrhages. The ten year old child complained during one year of vague abdominal troubles. Suddenly diffuse peritonitis shows and operation reveals a perforated ulcer of Meckel's diverticulum. The histological examination corresponds to Hubschmann's findings the ulcer was situated on the border of a large area of ectopical gastric mucosa.

Meulengracht⁸ (1918) gives the clinical record of a twelve-year-old boy who had melæna for some days after having suffered for weeks from abdominal pain. Two weeks later the child dies from septicæmia consecutive to otitis media. The necropsy shows a

PEPTIC ULCER OF MECKEL'S DIVERTICULUM

diverticular ulcer about to perforate and placed on the margin of a patch of ectopical gastric mucosa

In the case of Muller⁹ (1919) a child aged eleven is beset by persistent abdominal pain five months after having had melæna. Eight days later there suddenly appears a syndrome of peritonitis. At the operation there is seen a perforated diverticular ulcer. The perforation is sutured and the child recovers. Some weeks later the diverticulum is excised "à froid". Microscopic examination is absolutely identical with Meulengracht's case.

In 1922, Megevaud and Dunant,¹⁰ speaking of a fresh case, give a critical review of some former cases. Their patient, aged twenty-eight, has had since childhood repeating intestinal hemorrhage, the severest of which occurred at the age of four or five. As an adolescent he frequently passed blood from the bowel. The abdominal pain which he complained of was ascribed first to epigastric hernia, then to chronic appendicitis and at last to duodenal ulcer. The cure of the hernia and appendicectomy brought about no change in the state of the patient. Finally the third operation, performed after a new and extremely severe hemorrhage, reveals the existence of an ulcer at the base of a Meckel's diverticulum, bordering on the ileal mucosa. Resection of the diverticulum was followed by recovery. The diverticulum was entirely coated with gastric mucosa.

The case of Brasser¹¹ (1924) has been published under the heading *Ulcus pepticum perforans of Meckel's diverticulum*. A boy aged fifteen feels during a trip, pain in the lower abdomen. Ten days later there appear intestinal hemorrhages. The hemorrhages repeat and indicate an exploratory laparotomy which is performed with the provisional diagnosis of tumor or polyp of the colon. The colon is found filled with blood but otherwise normal. Loops of small intestine do not contain blood. The abdomen is closed, but eight days later there appears diffuse peritonitis which kills the patient within forty-eight hours. Necropsy shows the cause of hemorrhage and peritonitis: there exists a Meckel's diverticulum, as big as a pigeon's egg, with a club-like swelling on its free extremity. On its base, quite near to its insertion on the bowel, one perceives a hole of the diameter of a lentil. No other ulcer is found on the intestine. The histological examination shows that the club-like swelling was coated with typical gastric mucosa. The ulcer is astride on this gastric mucosa and the mucosa coating the remainder of the diverticulum and belonging to the intestinal type. The ulcer has all the microscopical characters of peptic ulcer.

In 1924, there are published the cases of Guibal and of Hallopeau and Humbert.

Guibal's¹² patient, fourteen years old, had for six months intestinal hemorrhages occurring with short intervals. The operation shows a chronic and callous ulcer on the borderline of diverticular and intestinal mucosa. The ulcer had scooped out a cavity in the mesentery of the ileum and opened there some small arteries; excision of the diverticulum was followed by recovery.

Hallopeau and Humbert's¹³ record is like our case of 1922, that of a male nursing eleven months old. The child had suffered, at five and eight months, from abundant intestinal hemorrhage. Three months after the last hemorrhage there is a sudden rise of temperature and the symptoms of diffuse peritonitis appear. Operation, performed on the third day, shows the presence of a Meckel's diverticulum, bearing on its anterior wall slightly nearer to its free extremity than to its base a perforation due to an oval ulcer, with clean-cut borders. Histologically a peptic ulcer in the border of a gastric mucosa area. The child dies on the same day.

Whilst the thirteen cases reported occurred mostly in male children, a fourteenth that came to be observed by Pascale¹⁴ of Naples is that of a man aged forty-one. The patient had suffered from several attacks of abdominal pain accompanied by emission of bloody and purulent stools. Operation was performed with the diagnosis of "ulcus simplex" of small intestine; there was found a Meckel's diverticulum with ulcer, whose peptic nature was corroborated by histological examination. Excision of the diverticulum was followed by recovery and suppression of abdominal attacks.

Taking as a basis the clinical records of the fourteen cases hitherto known, one can delineate the syndrome of ulcer of Meckel's diverticulum. Thus Hallopeau and Humbert studying its symptomatology have already laid stress on the fact that "clinically, hemorrhage and perforation are the essential symptoms of this disease." Nevertheless we ought to remember that the records published up to now belong to severe cases with a strikingly well-defined symptomatology. Possibly future cases will show that diverticular ulcer does not always belong to a type redundant with serious symptoms and that it may, as well as gastric and duodenal ulcer, exist without very definite and striking symptoms, or that it even may exist without any signs at all for quite a long time. Therefore we lay stress on the fact, that whilst giving here the clinical description of diverticular ulcer according to the published cases, we only describe its severe type with concomitating complications, such as forces itself on the patient and his family with its dramatic features and calls for immediate surgical aid on account of its serious prognosis.

Diverticular ulcer is a disease of childhood and appears at a time of life when gastric ulcer is practically non-existent. Two of the cases known up to now are those of nurslings who evidenced the first hemorrhage at five months, four children at an age from four to five years, seven from nine to fifteen.

It is interesting to note that all these cases appeared in male children.

The first and at the same time the most constant sign is abundant intestinal hemorrhage. Giemen's case is the only one where this sign was missed. As a rule the child begins to pass blood in full health, in some cases after having complained for some time of abdominal pain, it emits several times a day stools that are almost exclusively composed of blood of blackish or (and that must be carefully noted) reddish aspect, that is not modified by the digestive process. The amount of emitted blood is difficult to evaluate, but seems to vary from some tens to some hundreds of ccm. Anyhow there never is emission of sanguinolent mucus as seen in intussusception or dysentery, but genuine melæna.

The intestinal hemorrhage may last for some days or even for some weeks and produce in the patient a state of marked and even lethal anæmia. If the child keeps alive and if there is no perforation, the hemorrhage stops after a lapse of time, but only to start afresh after some weeks or months. This tendency to repetition constitutes together with the abundancy and the red color of the blood emitted one of the main characters of hemorrhage in diverticular ulcer.

Perforation is after hemorrhage the symptom complicating most frequently the clinical picture. It has been reported in ten out of fourteen cases, seven times it occurred into the free peritoneal cavity, three times into the neighboring tissues (abdominal wall, mesentery) with consecutive formation of adhesions and encysted abscesses. The perforation may occur during the hemorrhagic phase as in one of our cases (eight days after the onset of the melæna) or even some months after the last hemorrhage noted. In some

cases abdominal pain that could not be accurately localized appeared some days or some weeks before the symptoms of peritonitis

Palpation of the abdomen does not, as a rule, give a clue to diagnosis. In most cases the abdomen has been without defense and without any well-localized tenderness. In Hilgenreimer's case, where the diverticulum adhered to the abdominal wall, a para-umbilical tumor had been perceived before the operation.

The pain noted in several cases has no special features. It may be permanently diffuse or as in our case simulate colics. Hilgenreimer's patient, aged eighteen, complained of pain in the right para-umbilical region.

The clinical evolution of the disease can be long when the hemorrhage from the ulcer is well tolerated and when, by the formation of adhesions, perforation into the free peritoneum is made impossible. This must have been the case with Megevaud and Dunant's patient who was operated upon at the age of twenty-eight and had shown the first symptoms of the disease at four or five.

The marked tendency of diverticular ulcer towards perforation makes the *prognosis* particularly severe, if we may judge from the cases recorded. Of fourteen patients, seven died, six of those from diffuse peritonitis. Meulengiacht's patient died from intercurring infection. Only six patients could be saved by the operation, all of them were over ten at the time of operation.

Diverticular ulcer in children has so very marked a tendency towards perforation that one must always be in fear of it even when, after a first hemorrhage recovery has seemingly resulted. In Muller's case peritonitis suddenly appeared five months after a single melæna. Operation must be done immediately after the first symptoms have been noted.

Intestinal hemorrhage being, in the present state of our knowledge, the main symptom allowing to suspect a non-perforated diverticular ulcer, the *differential diagnosis* must be made with intussusception. When an infant suddenly passes blood from the bowel, one will suspect in the first place intussusception, which is of far more frequent observation than diverticular ulcer. But there are some signs that allow differentiation. Vomiting and colic-like pain are much more marked in intussusception. In intussusception blood is as a rule passed in small quantities and is intimately mixed with mucus, whilst blood is very abundant and in state of purity, partly black, partly red in the hemorrhage from diverticular ulcer. Once only have we met with an abundant hemorrhage, absolutely similar to that of diverticular ulcer in a case of intussusception of the small intestine that had been occasioned by a diverticulum Meckel.

The presence of a tumor "en boudin" perceived on palpation is in favor of intussusception, but one knows that this sign is often missed in the course and especially at the beginning of this disease.

Peritonitis is of frequent occurrence in both diseases. Abundance of

blood and absence of pus and mucus enable us to distinguish between diverticular ulcer and dysentery or infectious entero-colitis

Differential diagnosis with a bleeding polyp or tumor of the colon can be difficult and even, in some cases, be made only during operation

Lastly, melæna neonatorum cannot be mistaken for diverticular ulcer if one bears in mind that melæna is a disease of the first days of extra-uterine life, whilst diverticular ulcer does not appear before the child is some months old

The main point in the *pathology* of ulcer of Meckel's diverticulum is the constant presence in the affected diverticula of more or less extensive areas of gastric mucosa with pyloric glands, Brunner's and fundus glands. It is well known that heteroplasia of gastric mucosa in Meckel's diverticulum is not exceptional (occurring as it does in about 12 per cent of cases). They must no longer be considered as mere anomalies of development since they may have a very great pathological significance. Every diverticular ulcer, that has been subjected to histological examination, had developed on the margin of the gastric mucosa area on the borderline of the mucosa of intestinal type whether still intradiverticular or already ileal at its insertion on the intestine. The histological picture of the ulcer is that of gastric or duodenal ulcer, or better still, that of peptic ulcer of jejunum following gastro-enterostomy (Hubschmann). Its terrifying tendency is shown not only by the fact of its sometimes reaching quickly the diverticular serosa and perforating but also by its hollowing out a "niche" in the mesenterium or the abdominal wall, according to its seat and its adhesions. From this point of view there is a perfect analogy with duodenal and jejunal ulcer. This analogy might be traced further, one might for instance establish a distinction between the chronic and callous and the acute type. It is enough to say that Meckel's diverticulum, whether with a total or only a partial coating of gastric mucosa, can and does behave like a miniature stomach (Guibal). The general outline of its pathology is that of gastroduodenal pathology.

This brings us to the discussion of the pathogeny of diverticular ulcer. Diverticular ulcer is a peptic ulcer, it develops at the union line of two mucous membranes one of which, of gastric type, possesses an acid secretion that can corrode the epithelium of the other, of intestinal type, accustomed only to perfectly alkaline juices. After all, this explanation does not solve the pathogenic problem because all diverticula with heteroplasia of gastric mucosa certainly contain acid secretions (Lever,¹⁶ Tillmanns¹⁷), but do not therefore necessarily have there peptic ulcer. We fully believe that records like those we have given, are entitled to a prominent consideration in further study of the origin of peptic ulcer generally speaking. We do not intend to open the discussion here.

One must conclude from this chapter that the diverticular ulcer is a peptic ulcer mostly of acute evolution opening vessels penetrating into neighboring organs and making its way towards the free peritoneum, it then perforates and provokes diffuse or limited peritonitis. The ulcer of the diverticulum

has nothing to do with "diverticulitis", the latter stands in the same relation to the diverticulum as appendicitis to the cæcal appendix. Certainly perforating diverticulitis has more than once been mistaken for perforated diverticular ulcer, before Hubschmann's fundamental report and even afterwards.

Treatment of peptic ulcer of Meckel's diverticulum may have to be undertaken under three circumstances.

I The ulcer is diagnosed "*à froid*," that is to say, without there being hemorrhage or perforation at the time.

The only logical therapeutic measure is then surgical removal of the diverticulum with the ulcer. It suppresses every possibility of ulterior accidents.

II One has to deal with a profuse intestinal hemorrhage exhibiting the characters described above. It is then likely that it is due to a diverticular ulcer, without one being absolutely certain that it does not come from a tumor or a polyp of the colon.

Here also—contrarily to the usual treatment of hemorrhages from gastroduodenal ulcers—instantaneous surgical action is necessary. We say instantaneous because once a diverticular ulcer has begun to bleed it often perforates very quickly and quite unexpectedly. It is better to operate a child even markedly anæmic than to run the risk of being obliged to act under much more severe conditions when the peritoneum is already flooded with highly septic matter.

A small subumbilical median laparotomy will quickly show the seat of the hemorrhage. It is easy to make out whether the colon and the last ileal loops contain blood, whereas the higher ones do not show any. One does not encounter here the difficulties one has to overcome in order to find a small hemorrhagic ulcer of the stomach or the duodenum. Diverticular ulcers can only bleed inside a tiny organ which can in most cases be easily excised in toto. By taking out the diverticulum one is certain to have stopped the hemorrhage and prevented all other complications.

The results of radical interventions during the period of hemorrhage—still few in number—show that this active treatment is well founded. The cures obtained by Guibal and by Dunant are absolutely demonstrative from this point of view. One will usefully fight the anæmia and operative shock by blood transfusion.

III One is called when the ulcer has already perforated into the peritoneal cavity. If the symptoms of peritonitis have not been preceded by the typical intestinal hemorrhage, the diagnosis will be in most cases that of perforated appendicitis because the first signs appear on the right of the abdomen. A tendency to wait under these conditions—faulty as well in appendicitis—would lead to unfortunate consequences.

Peritonitis by perforation of diverticular ulcer holds a more serious general prognosis than perforated gastric ulcer. This is due to the fact that it affects almost always children and that the fluids invading the peritoneal cavity, coming from the inferior extremity of the small intestine, are, except

perhaps in the nursling, considerably septic. One should not hesitate a moment to undertake the surgical act that alone can save the patient.

What shall be the operation? A minimum intervention or removal? Resection seems only indicated in cases when one is, as who should say, eye-witness of the perforation. Consequently the indication will be exceptional. If peritonitis has already had time to extend—and a few hours are enough for this—one must be satisfied with a minimum action. Obturation of the hole and cleansing the peritoneum will then be the main indications. The radical operation will be performed after all peritoneal complications have disappeared. Muller cured his little patient by proceeding this way. Another method of rapidly suppressing the source of peritoneal infection would be to act as we did: exteriorise the loop with the perforated diverticulum according to well-known principles. It allows, moreover, to ligate without any danger the mesenteric vessels whose branches may only be imperfectly thrombosed at the level of the ulcer. The enterostomy which forms spontaneously after the fall or the removal of the diverticulum may certainly be useful in the treatment of the peritonitis. Its disadvantage is the secondary operation of closure which may be necessitated and which sometimes is the equivalent of an intestinal resection.

Therefore the treatment of peptic ulcer of Meckel's diverticulum is essentially surgical. It is to be hoped that on the gradual spreading of the knowledge of this interesting disease amongst physicians and surgeons, its diagnosis will be made more often and in earlier phases. The treatment shall then without any doubt be more efficacious.

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DILATATION OF THE COMMON BILE DUCT IN THE ABSENCE OF FUNCTIONING GALL-BLADDER*

BY ROBERT C. COFFEY, M.D.
OF PORTLAND, ORE

IN THE course of experimental work for the study of the mechanism of duct delivery of the secretions of an organ into a reservoir or a functioning hollow organ, it has been found that there is something far more important in the transplantation of the delivery end of a duct from one organ or location in the body into a new organ or new location than the mere technic of the performance. Fundamental questions are involved. The technic of the operation by which the transplantation is done bears the same relation to the transplantation, in its entire significance, as the artisan's work bears to the construction of a great building, a bridge or a railroad. It is necessary to study such abstract fundamental principles as the general transmission of matter by force or power against gravity or other forces, the transmission of matter by force or power against gravity or other forces by specific measures, such as through a confined passageway or tube, more specifically the transmission of fluids and gases of the body against static intra-visceral or intra-vascular pressure, the principle of valve action, the structure and relative function of valves and sphincters, etc.

Most of the great motive forces of Nature travel in waves. Biological activity is usually intermittent. The plant rests in winter. The animal sleeps while force is regenerated. The overloaded, stalled locomotive rests while the fires burn and more steam is generated. The man carrying a heavy load up a hill temporarily lays down his burden while the fires of his body create new energy. A teamster hauling heavy loads up a long steep hill, in a wagon which has no brakes, has a block of wood attached to one side of the wagon so that it drags passively behind one of the rear wheels. When the team stops to rest, the wagon recedes a few inches and the wheel rests against the block, so that no ground will be lost and all the new energy of the team which has accumulated during the rest period will be utilized in the forward movement of the load without reduplication of effort. The block automatically stops the wagon without any effort or animation and is passively in place when needed again.

A power pump located ten feet above a river lifts water through an enclosed pipe to a height of 100 feet against gravity. The force lifting the water is applied intermittently. During the intermission an inanimate piece of metal automatically slips under or behind the load and holds it until another application of the propelling force. This piece of metal is called a valve. When the propelling force is applied to the piston which lifts the column of water, a vacuum is formed in the wake of the piston. The valve

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opens toward the area of lesser pressure followed by an inrush of water from the river. If the motive power ceases, the weight of the water in the pipe closes the valve and holds it. The pressure which holds the valve closed during inaction may be called static pressure. The heart, an animated, innervated, muscular organ, propels the blood through an elastic tube against a resistance amounting to a certain number of millimetres of mercury. Its efforts are intermittent. During intervals of activity, the heart rests like the team. While it rests, the force against which its activities are directed rebounds and automatically spreads out three small inanimate, non-motile, membranous folds which block the opening and prevent further recession. In other words, they hold the load while the heart rests. These membranous folds are called valves. The pressure holding the valves closed during the rest period is known as diastolic pressure or may be called static intra-vascular pressure.

Stedman has given an anatomical definition of valve as "Any membrane or duplicature of a membrane which prevents a reflux in the vessels and canals of the body." I think a more specific definition would be the following: A valve is a non-motile, inanimate, movable gate or obstruction, placed at the threshold or in the course of a vessel or tube, which automatically acts to prevent a reflux of matter from an area of greater into one of lesser pressure.

A sphincter is a motile, innervated gate or obstruction placed at the threshold or in the course of a cavity or canal, for the purpose of retarding the onward or outward flow for the convenience of the biological or animal mechanism.

A valve is equally active in an animate and an inanimate mechanism. A sphincter is effective only when animated or innervated. In the animal mechanism, a valve is used where the activities of vital organs are to be certainly protected. A sphincter is for the purpose of improving function. The true valves of the body, such as those which protect the outlet of the ureter into the bladder, of the bile duct into the duodenum, of the heart into the aorta, function just as well after the patient is dead as during life. A sphincter ceases to function during paralysis or at death.

A study of the outlet of the ducts carrying the secretions of the liver and the kidneys reveals the fact that the terminal portion of these ducts run under a loose, non-animated fold of membrane before entering the lumen of the viscus where intra-visceral pressure is greater than that of the secreting organ and its ducts.

In the Jubilee number of the *ANNALS OF SURGERY*, issued December, 1909, was published a paper of mine with the title, "Pancreato-enterostomy and Pancreatectomy." This paper was a report of six months' experimental work conducted with the view of studying principles and developing a method of dealing with an obstructive lesion in the head of the pancreas. Two plans were used. In one the tail of the pancreas was cut off and implanted into a specially constructed loop of bowel after first obstructing the normal delivery ducts. This was accomplished and the duct delivered its secretion back into the intestine without injury to the pancreas. The other plan was to remove

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the head of the pancreas and implant the cut end of the pancreas into a similar loop. For chronological accuracy in the development of this subject, I will quote that part of the wording in this article which bears on our present subject:

"Pancreatectomy was done in two stages as follows. First operation—The common bile duct was transplanted into the duodenum lower down, gastro-jejunostomy was performed and the stomach was cut off and ends turned in just above pylorus. Second operation, or second stage of operation. The body and duodenal tail of the pancreas and

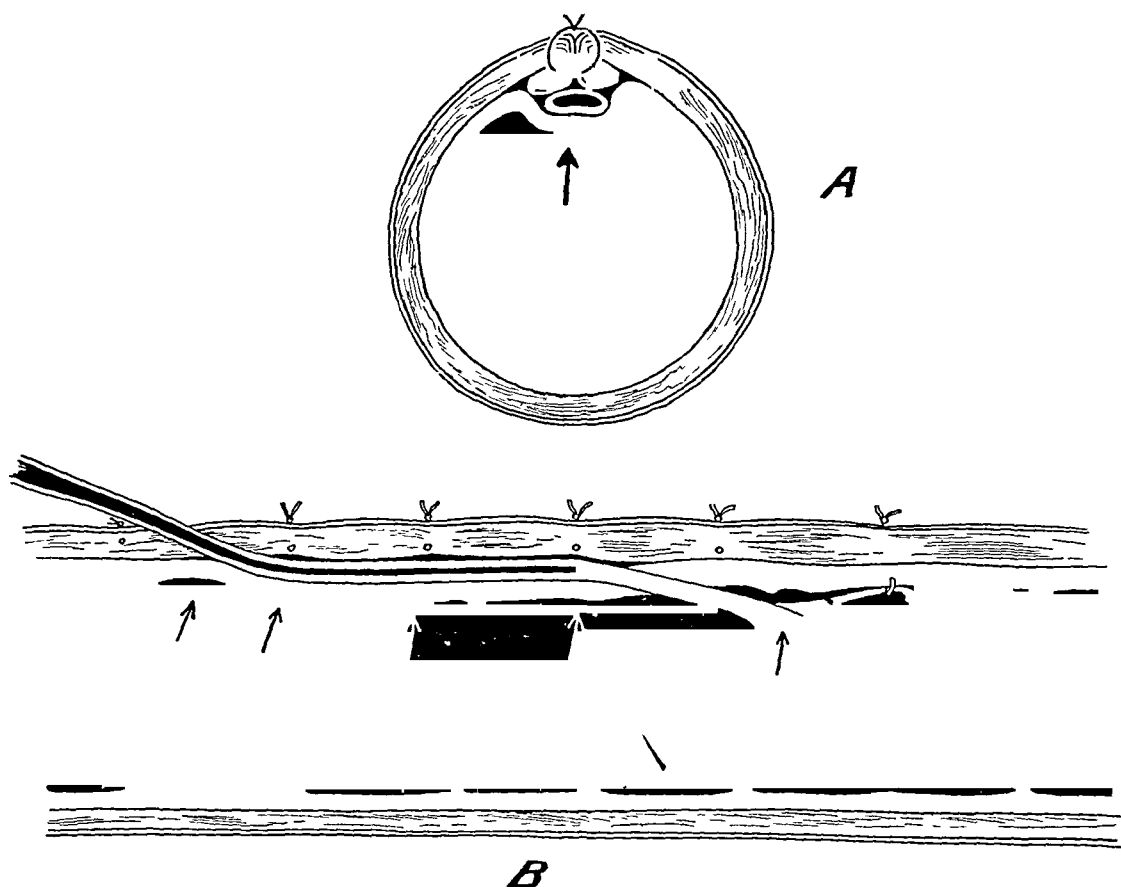


FIG. 1.—Sectional view (diagrammatic) illustrating the relation of the bile duct to the coats of the intestine after physiological implantation of the bile duct. (Arrows indicate the direction of intra-intestinal pressure.) A cross-section. B longitudinal section. *ANNALS OF SURGERY*, December, 1909.

the duodenum were removed and the retrogastric tail of pancreas was planted into a loop of jejunum.

"The common bile duct which had been transplanted at the first operation was as large as a man's finger, while the mouth would admit a lead pencil. The hepatic ducts were distended in the same way well up to the liver. Five other dogs with the same operation showed the same condition of bile ducts."

The seventh conclusion after the first series of experiments was "A bile duct which has been transplanted by the direct method, becomes widely dilated and at the same time thickened by intra-intestinal pressure of some kind, which may have a very important bearing on this subject." This brought up a new problem which was dealt with in the manner described in the following words:

"Our next defect was in our method of implanting the bile duct. By studying the bile duct of the dog, it was observed to run under the mucous membrane of the duodenum for almost one inch before it opened out into the canal. It was at once seen that this arrangement effectually prevented the intra-intestinal pressure from being brought to bear from within the duct, owing to the fact that it was brought to bear along the course

of the duct through the mucous membrane, thus effectually making a valve. The problem then was to duplicate this condition as near as possible. The first thought was to split apart the layers of the intestine with forceps and drag the duct through. This was a cumbersome method until we were reminded of the protrusion of the mucous membrane which occurs after the outer coats of the stomach and intestine have been cut through.

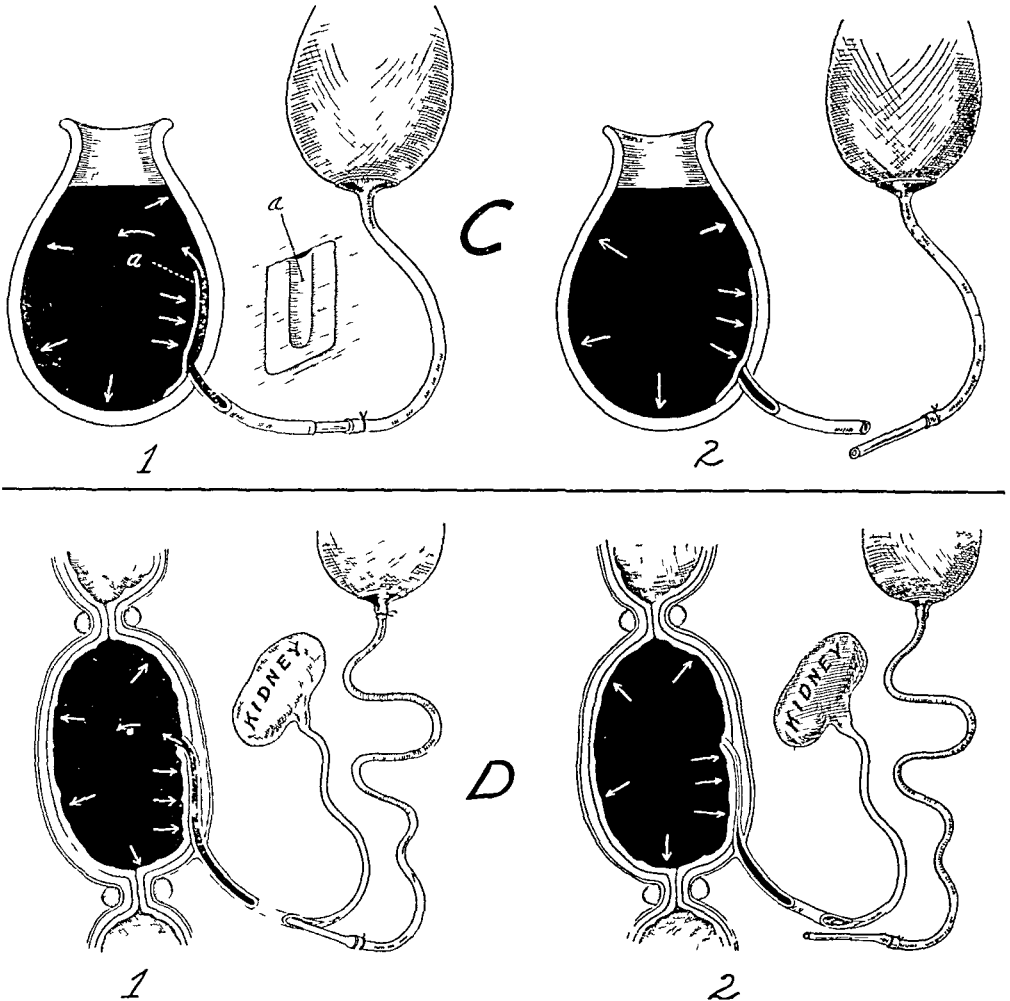


FIG. 2 —C Partial artificial lining of a rubber bag with a thin piece of rubber cemented on the inside. 1 The fluid is running into the bag notwithstanding the pressure indicated by the arrow because the height of the fountain syringe produces greater pressure than exists in the bag. 2 When the greater pressure from the fountain syringe is removed the intravesical pressure collapses the inside lining.

D Segment of intestine into which the ureter was implanted 169 days prior to removal of specimen. 1 Running fluid into segment of intestine under pressure. (A counterpart of experiment made on rubber bag Fig 2 C). 2 Shows pressure of fountain syringe released by withdrawal of nozzle. The pressure within the intestine immediately closes the valve by pressure of the mucous membrane. Not a drop could be forced back into the duct. (An exact drawing of the valve in the same specimen is shown in Figure 4 compared with the valve in a normal dog's bladder Figure 3.)

during the operation of gastro-enterostomy. The following operation was, therefore, devised for implanting the bile duct.

"First, the duct is located and ligated with linen or silk near its point of entrance into the duodenum. It is then cut in two and the edges caught and held with mosquito forceps while one wall of the duct is split down with a pair of scissors. A linen suture is now passed through the split end of the duct so as to include about half of it and tied. The linen thread is then thrown around the other half, and tied. The loose end is then threaded into another needle. By this method the full strength of the duct is then retained for traction while the opening is maintained by the split. The end of the duct is now wrapped in gauze while the intestine is prepared for its reception, which

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is done as follows Pick up the part of the intestine desired and cut down through the peritoneal and muscular coats, including the submucous tissue until the mucous membrane pouts out through the incision This incision should be about one inch long Second pass five sutures which pick up the peritoneal and muscular coats on each side of the incision Tie the suture at the upper end of the incision Lift up the three intermediate intestinal sutures on the flat handle of an instrument, as they cross the incision Make a small stab wound in the mucous membrane near the lower end of the incision Now bring the intestine close down to the end of the split duct and pass the two needles carrying the threads on the end of the duct, beneath the three intestinal sutures and into the intestinal lumen through the stab wound in the mucous membrane and out through



FIG 3 —The valve in a normal dog's bladder is lifted on the end of a probe

the intestinal wall one-half to three-quarters of an inch further along the intestine and one-eighth to one-quarter inch apart By making tension on these threads and at the same time pushing the intestine toward the duct the bile duct is drawn beneath the intestinal sutures and into the intestinal lumen, through the stab wound, when the two ends of the threads on the duct are tied on the outside, thus anchoring the end of the duct on the inside of the intestine at this point The intestinal sutures are then tied After this operation the duct lies just beneath the mucous membrane, which has been loosened for approximately three-quarters of an inch of its course, so that the intra-intestinal pressure is brought to bear on the duct along this entire distance, thus counteracting the intra-intestinal pressure which in the direct implantation is brought to bear in the inside of the duct" (Fig 1 A and B)

Immediately after the meeting in December, 1909, I began another series of experiments on the bile duct and on the ureters, using the same principles The results were reported and specimens exhibited to the Surgical Section of the American Medical Association at St. Louis, in June, 1910, under the

title "Physiologic Implantation of the Severed Ureter or Common Bile-duct into the Intestine" Illustrations for the technic adapted to the implantation of the ureters were submitted and published with the report in the *Journal of American Medical Association*, vol 1vi, February 11, 1911

The results of experiments were published in this article as follows

"In five dogs with direct implantation of the bile duct, all specimens showed marked dilatation, of the four dogs in whom the duct was transplanted by the submucous method, none showed dilatation of the duct Of six dogs in whom direct implantation of the ureter was performed five died with pyonephrosis as a result of the operation while

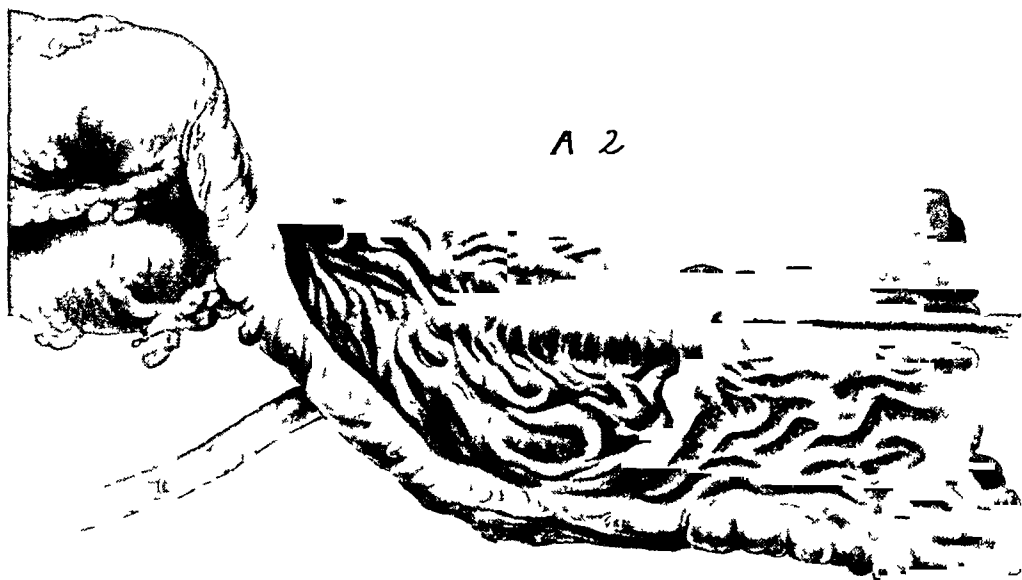


FIG. 4 — The valve in a dog's intestine following submucous implantation. Specimen removed 167 days after implantation. Compare with valve in dog's bladder Fig. 3

the sixth lived and was killed sixty-one days after operation when it was found that the kidney with implanted ureter had been totally destroyed, leaving only a shell of fibrous tissue while the ureter was dilated and remained wide open. Thus, every ureter and every bile duct which was transplanted directly into the intestine without valve formation dilated throughout its extent, including its opening into the intestinal lumen. On the other hand, of nine dogs whose ureters had been implanted by the submucous method, four had died operative deaths from general complications such as may be encountered in any form of complicated abdominal surgery. The five who recovered from the immediate effects of the operations showed undamaged kidneys and undilated ureters when the dogs were killed at periods ranging from 60 to 167 days after operation. Removed specimens when tested showed that the valve action was perfect mechanically in the dead intestine as well as in the living. In Fig. 2-d is shown a post-mortem experiment which was made in all these cases. So perfect was this valve in one instance that by using my entire weight and stepping on the obstructed intestine, rupture of the bowel occurred without causing a reflux of the fluid through the ureter which had been injected. All the other specimens in this series showed similar valve production. Figures 3 and 4 show the similarity of the valve which has been surgically constructed in the course of the submucous implantation of the ureter to the normal valve in a dog's bladder.

It may, therefore, be said (1) When a duct is implanted into the intestine directly without valve formation, the duct always dilates. (2) When valve formation is produced the ducts do not dilate. (3) Valve formation is pro-

duced by running the duct under the loose, non-motile, unanimated mucous membrane for a distance before the duct emerges into the intestinal lumen. This valve forming operation has been proved efficient clinically in nearly a hundred operations by C. H. Mayo and twenty-eight by Dr. W. E. Lower, and some fourteen by myself, and a considerable number by Drs. Frank Hinmann, Hunner, Bartlett and others, making a total of almost two hundred of which I have heard.

It is an interesting fact that Dr. Franklin H. Martin, in 1898, devised a method of implantation of the ureters into the bowel which on casual observation very closely resembles this submucous implantation above described, but when his own statement concerning the purpose of the technic is studied, it is found that the resemblance is not so close as it appears, for instead of cutting through the muscle of the intestinal wall and burying it so as to get the valve action of the collapsible mucous membrane, he carefully exposed the muscle of the intestinal wall without cutting it and wrapped it around the lower end of the ureters so to speak, with the evident purpose of producing a sphincter instead of a valve. He failed only by the thickness of the muscular coat of the intestine. It is conceivable that in the one dog who survived in Doctor Martin's series, the cut might by accident have extended through this thin muscular coat. As has been stated in the differentiation between a sphincter and a valve, a sphincter is used to regulate outward or onward flow and is under the control and caprices of the nervous system while a valve is a non-animated structure and works just as well on an inanimate subject as a live patient and is, therefore, always sure to act in response to the force it is intended to resist. The valve is the only automatic mechanism used in nature by which the secretion of a vital organ with low intra-visceral pressure is regularly delivered into another organ or reservoir of higher intra-visceral pressure.

The pressure in the gall-tracts is much less than the static pressure in the intestine where the gall-duct empties. I am sure many a surgeon is familiar with the phenomenon of an obstructed sigmoid, an enormously distended cæcum, and an undistended small intestine in the same abdomen. This small intestine with low intra-visceral pressure still delivers its contents into the distended cæcum where the static pressure is much greater. This phenomenon is only possible in the presence of a perfectly acting ileo-cæcal valve, as shown by the fact that when the ileo-cæcal valve is short-circuited by an ileo-sigmoidostomy, the ileum dilates synchronously with the large intestine and its intra-visceral pressure becomes the same. The mechanism here is the same as that of the bile under low pressure in the gall-tracts being delivered into the duodenum where the static pressure is much higher. Though the duodenum food is propelled by rhythmic contraction of the muscular wall ordinarily referred to as peristalsis. In the absence of this propelling force, food would remain stationary, the intestine would become filled with gas under a steady pressure which we may speak of as static intra-intestinal pressure. This pressure would hold the valve closed against the lesser

pressure in the gall-tracts until such time as the gall-tract pressure became equal to the static pressure in the duodenum. When peristalsis is active, a propelling wave drives the contents of the duodenum forward. In the wake of this peristaltic wave, a diminished pressure or relative vacuum is produced. During this release of pressure, the bile under low pressure may now move forward into the intestine, even without any propulsion from the upper stretches of the gall-tracts. When the peristaltic wave is spent, the intestine fills out and its contents assume a normal intra-intestinal pressure which, while it is stationary, may be called static intra-intestinal pressure. This pressure closes the valve at the mouth of the duct. When another peristaltic wave passes along the intestine, another vacuum follows in its wake with another emptying of bile into the area of reduced pressure, etc. What proof have we that this takes place? Every surgeon has noted in his practice that a biliary fistula following gall-bladder damage or duct drainage discharges at night for several days after it has ceased to discharge in day-time. Kehr observed that if these patients were fed at regular intervals during the night, the flow of bile was no greater at night than in day-time. In other words, this flow was not a question of night or day, but was a question of the period of digestion. We have now come to a definite knowledge as to the purpose of the gall-bladder. Mann and others have shown that bile which has been retained in the gall-bladder for some time may be concentrated to ten times that of freshly secreted bile. He has also determined that it is difficult to produce jaundice in a dog even by ligation of the common duct if the gall-bladder is functioning normally. On the other hand, jaundice deepens rapidly after the gall-bladder has been removed. Therefore, the definite function of the gall-bladder as a reservoir and concentrator has seemingly been established. During the hours when active digestion is taking place, it is safe to assume that active peristaltic waves are passing along the duodenum. In the wake of each of these waves, an area of diminished pressure is formed. Into this area of diminished pressure, the bile, which itself is under low pressure, may be delivered. With the cessation of the peristaltic wave, normal intra-intestinal pressure is reestablished and the valve is closed. The greater the number and strength of peristaltic waves, the more frequent the opportunity for the delivery of bile under low pressure into the intestine. In the absence of food in the stomach and duodenum peristaltic waves are diminished in number and strength. Normal intra-intestinal pressure is more or less constant. In the presence of the normal intra-intestinal pressure, without the periodic relaxation in the wake of the peristaltic waves the valve of the gall-duct is held closed by the intra-intestinal pressure until the pressure in the gall-tracts is equal to the intestinal pressure. If there is a drainage tube in the gall-bladder or in the duct, the bile pours out through the drainage tube. If there is no drainage and the gall-bladder is normal, bile is poured into the gall-bladder and is thickened up by the absorption of the watery content and stored for later use. Therefore, the period during which the gall-bladder is called upon to function as a reservoir is during the time when no digestion

is going on. If the gall-bladder has been removed, there is no reservoir. Therefore, during these intervals between periods of digestive activity when there are few peristaltic waves, and the intestinal contents are quiescent, the normal static pressure existing in the intestine holds the valve closed and produces exactly the same pressure in the ducts. The result is that the ducts dilate from the static intra-intestinal pressure, the bile having no gall-bladder into which it can go. These dilated ducts occur when the gall-bladder is filled with stones or pus when the wall is thickened and has lost its elasticity, when its walls are contracted, and after the gall-bladder has been removed. In short, the common duct dilates in the absence of a functioning gall-bladder. Judd and Mann have claimed that the action of the sphincter of Oddi is important in this connection. Our experiments of transplantation of ducts into the intestine show that when a valve is not produced by the operation, the duct always dilates. When a true valve is produced, it does not dilate. This independent of any sphincter whatsoever.

IS SUCH DILATATION HARMLESS?

It must be conceded that in the great majority of cases, dilatation of the duct gives no very remarkable clinical symptoms yet we know that in a few cases new stones form in such ducts. In many more of these cases the patients are not entirely well. Occasionally we are called upon to operate upon a patient because of the symptoms. During the year 1924, I operated upon two such cases.

CASE I.—The first patient was operated upon September 13, 1924. I had operated upon her previously on February 17, 1923, at which time I found a gall-stone impacted in the cystic duct. The gall-bladder was filled with mucus. The common duct had several stones in it and the fluid in the common duct was mucopurulent with but a slight tinge of bile. The duct at this time was slightly dilated, the stones moved up and down with ease. The gall-bladder was removed and drainage tube placed in the common duct after all the stones had been carefully removed and a good opening into the duodenum was assured. Stenographic report taken as operation proceeded.

The patient again comes to operation with the following history since the first operation. From time to time she has had slight fever, distress in the neighborhood of the gall-bladder a great deal of the time and at times has been slightly yellowish although I think she has not shown real jaundice. She has been in the hospital much of the time recently. All the time we were certain that all the stones had been removed. We also knew that we had an infection in the bile duct which probably was not completely removed. She was finally turned over to my associate, Doctor Sears, who treated her medically. He now advises a second operation with the belief that there must be something either in the way of infection or stone in the common duct. She has not had the chills and fever that common duct stones usually show, but she is not well and we are going to open the abdomen again.

We note the enormous common duct. It is at least three-fourths inch in diameter and is thickened but by careful examination I can detect no stone. I take a large hypodermic needle and insert it into the duct and withdraw pure yellow bile. No evidence of infection or trouble of any kind showing so far. I pass two traction loops through the wall of the duct and between the loops make a longitudinal incision into the duct sufficiently large to admit my index finger easily. In passing the finger upward I

detect the bifurcation of the hepatic duct. No evidence of a stone or trouble of any kind. It is possible that there is a stone down in the ampulla of Vater. The duct is large enough so that I easily pass my finger downward. No stone is encountered. The index finger passes easily into the duodenum. The mucous membrane forms a rather tight stricture about my index finger which passes well into the duodenum. The head of the pancreas is not materially hardened. We have here a greatly dilated common duct, no evidence of infection, no evidence of stones, no organic obstruction, and yet the patient is having serious trouble. We have a duct almost as large as a duodenum, with an opening that is half as large as the duodenum itself. I can see no good purpose that drainage can accomplish in this case. I therefore close the duct by sutures and place a very small drain down in the neighborhood. Nothing has been accomplished by the operation except the discovery of this enormously distended duct, which in reality is a diverticulum of the duodenum.

CASE II—November 2, 1924. This patient, a man sixty-three years of age, was registered on October 2, 1924, with the following history. In 1905, he was operated upon for gall-stones by a very good surgeon, after having had frequent attacks of gall-stone colic, with a pain also occurring under the left rib arch. A small gall-bladder containing stones was removed at the time and a small rubber tube drain was used. The patient was not entirely relieved of the left-sided pain.

For three years just past he has periodically had sharp, increasingly severe attacks of pain in the left upper abdomen, exactly similar to the pain which he had before the gall-bladder was removed nineteen years ago. Recently he has had more frequent attacks, and for the past three weeks has been almost constantly ill. He has had a feeling that the pain has something to do with meals but his physician, an internist of note, finds there is bile in the urine after each of these attacks of pain. The internist is of the opinion that there is probably an obstruction in the common duct, possibly gall-stones.

In our examination we have found there is definite gastric hyperacidity. Patient has been under observation for a month, during which time he has had other attacks of pain in the left side of the upper abdomen. Bile has each time been discovered in the urine along with a gradually increasing jaundice in the skin and sclera of the eyes. Having had the experience of a case with a similar history recently, we come to operation with the pre-operative diagnosis "Dilated common duct with possible pancreatitis."

Observations during operation. The stomach is firmly adherent to the under surface of the liver in the bed, from which the gall-bladder had been removed at previous operation and cannot be separated without dissection. Dissection is made with difficulty. After mobilizing the duodenum and stomach from the bed of adhesions, the common duct is found. It is three-fourths inch in diameter, its wall practically as thick as shoe leather, yellowish-white in color with a few blood-vessels running across it. A hypodermic needle introduced into the duct shows pure yellow bile, no stones.

Two traction loops are placed in the wall of the duct toward the liver end, a long incision is made in the middle of the duct between the two loops. The gloved index finger passes easily to the bifurcation of the hepatic duct. No stone found. There is ample room for easy passage of the finger. The index finger is now turned downward and passes easily into the duodenum. The last joint of the index finger passes through the channel in the head of the pancreas rather tightly and through the ring of mucous membrane which makes mild constriction on the finger. A large prostatic sound No. 26 passes easily into the duodenum. Two inches beyond the pancreas the point of the sound is made to show pressure through the wall of duodenum. Bile in the duodenum is yellow and pure showing no evidence of inflammation or pus.

The liver is adherent to abdominal wall but normal in every way. Head of pancreas is hard but not materially enlarged. Owing to the fact that the patient has definite jaundice, I take a chance on the duodenal contents regurgitating back into the common

DILATATION OF THE COMMON BILE DUCT

duct with the hope of temporarily relieving the intra-intestinal pressure on the smaller liver ducts. A tube the size of a lead pencil is passed into upper end of duct toward liver. The duct is sutured around the tube. A fold of omentum is drawn across the pylorus and duodenum and sutured to prevent reunion of stomach and raw surfaces.

This case had the complication of a stomach firmly adherent to the abdominal wall, therefore, some of the symptoms notably the excessive gastric acidity might have been due to this, but it is hard to conceive of the stomach causing a real jaundice, and it certainly would not cause bile to appear in the urine after each attack of pain. The patient has been greatly relieved but still has some pain in the neighborhood at times. It is possible, of course, that even such extensive dilatation of the ducts as is shown in these cases may do no harm, but such conditions cause one to think. I am sure we would all prefer not to have such a duct.

ASEPTIC END-TO-END SUTURE OF INTESTINE

By JOHN E. SCARFF, M.D.

OF BALTIMORE, MD

FROM THE DEPARTMENT OF SURGERY OF THE JOHNS HOPKINS UNIVERSITY

IT WAS recently observed that if the walls of an empty loop of bowel are approximated and strongly crushed in a clamp the walls will adhere to each other quite firmly and the intestinal lumen remain occluded after the clamp has been removed.

This fact has been utilized in the development of an exceedingly simple

and satisfactory technic for aseptic end-to-end anastomosis of intestine.

Technic—No special instruments are required. Blood supply is controlled by fine silk sutures as shown in Fig 1, sutures marked L-1 and L-2 being placed near the radial arteries of supply. Medium Kocher clamps which have first been dipped in sterile white oil are now placed across the bowel in the manner shown in Fig 1. The ends of all four clamps

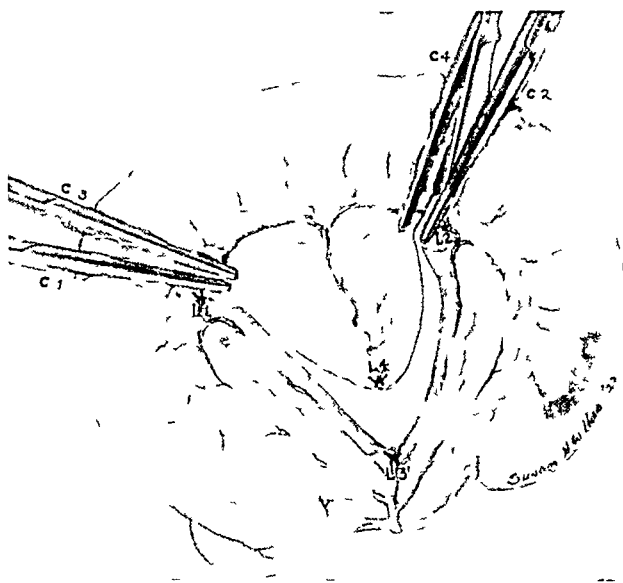


FIG 1.—The method of controlling the blood supply of the bowel with fine silk sutures is shown in this illustration. Observe that the edges of the clamps C-1 and C-2 are placed in contact with the silk sutures L-1 and L-2. Also that the tips of the clamps C-3 and C-4 control all back bleeding from the loop which is to be removed.

should extend across the longitudinal vessel in the mesentery. Extreme care should be taken that the lateral edges of clamps C-1 and C-2 just touch the fine silk ligatures L-1 and L-2. These clamps should cross the bowel somewhat obliquely so as to make the antimesenteric edge of the intestine which is to be sutured shorter than the mesenteric edge.¹ The success of the procedure following depends entirely upon the condition of the clamps. The grasping surfaces must oppose accurately and tightly throughout their whole length when the clamps are closed. The mesentery and bowel are then cut as shown in Fig 1, and the diseased portion of the bowel between clamps 3 and 4 removed. It is particularly important that the edge of the knife should rest tightly against clamps C-1 and C-2 while the bowel is being divided, and that no loose shreds of tissue be left protruding beyond the clamps. The edges of the clamps are then touched with pure carbolic and alcohol.

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Clamps C-1 and C-2 are now approximated and held in the operator's left hand, while Halsted mattress sutures of fine black silk threaded upon straight intestinal needles are laid as shown in Fig 2. The first suture is placed in the bowel wall as near the mesenteric border as is possible, but so as to avoid carefully the mesentery itself, and the remaining sutures are placed at regular intervals between the mesenteric and the anti-mesenteric borders. For the time being these sutures are not tightened. The clamps are now turned over and the procedure repeated upon the other side of the bowel. All sutures are placed as close to the clamps as possible and the greatest care is exercised with each suture to take a deep bite and to pick up a part of the tough submucosal layer, for upon this latter point, as shown by Doctor

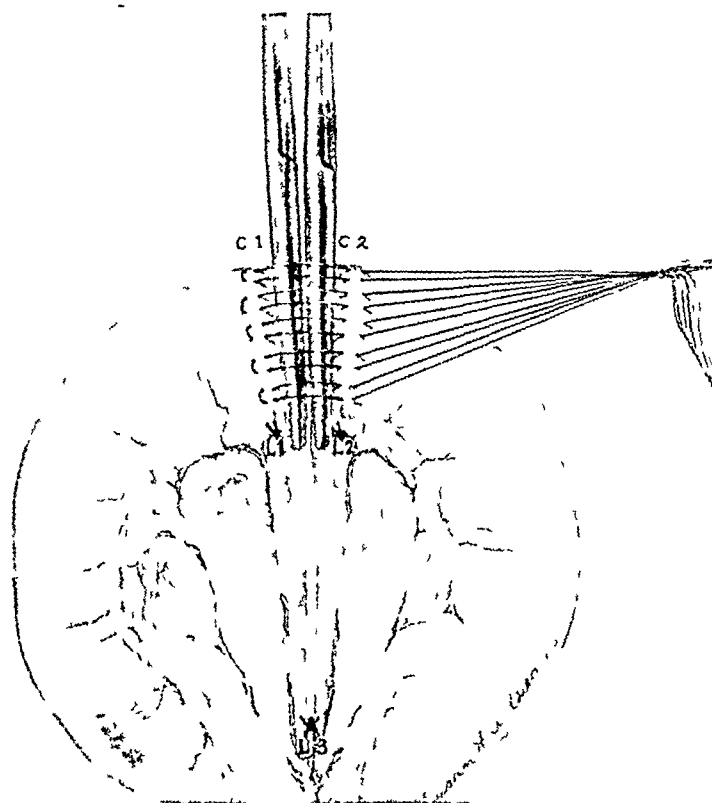


FIG 2—The clamps C-1 and C-2 are held together in one hand while Halsted mattress sutures of fine black silk threaded on straight intestinal needles are placed as shown. These sutures should be placed somewhat closer to the clamps than in the illustration.

Halsted, depends the strength of the suture line. The work of Reichert and Holman² has shown that silk sutures may enter the lumen without endangering the strength of the anastomosis.

The clamps are now carefully removed one at a time. In doing this the bowel just behind the suture line is grasped by the thumb and forefinger of one hand, and the clamp closing that end of the bowel is grasped in the other. As the clamp is slowly and carefully opened, it is gently pulled away from the end of the bowel. It

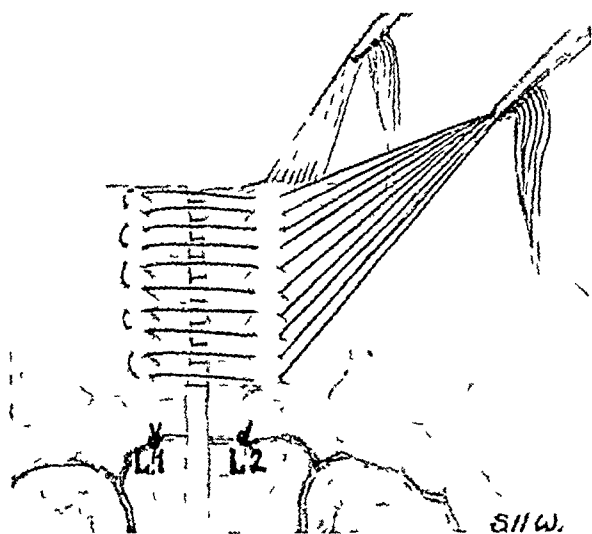


FIG 3—The Kocher clamps have been removed leaving the crushed ends of the intestine tightly sealed. Note particularly that all of the tissues holding sutures have their blood supply well preserved while the tissues to be returned are thoroughly devitalized.

comes away smoothly, leaving the crushed end of the bowel tightly sealed (Fig 3).

The small bits of mesentery which were crushed in the clamps are trimmed away, care being taken not to cut the ligatures on the longitudinal vessel. The free ends of the mattress sutures are then gathered up into two bundles

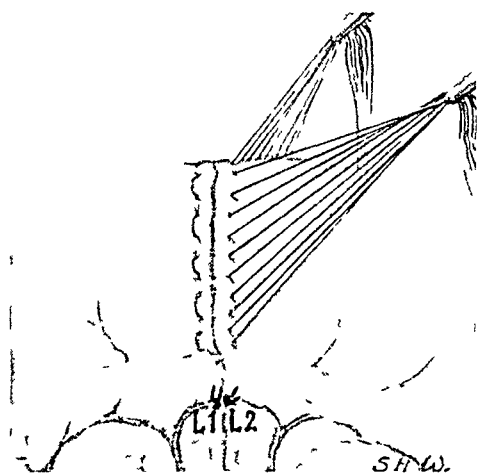


FIG 4—This illustration shows apposition of the ends of the intestine after traction on the free ends of the sutures. The individual sutures are now tied one at a time.

(Fig 3) and steady traction is made on them. This draws the two ends of bowel together, inverts the edges, and gives accurate approximation of the serosa before the mucosal layers have time to separate or permit leakage. After this, the individual sutures are tied one at a time without need of haste, care being taken not to draw the sutures too tightly. Lembert sutures may be interpolated between the mattress sutures if needed. The mesentery is repaired with interrupted sutures (Fig 7). After the suture has been completed, the continuity of the intestinal lumen is definitely reestablished by

simply pulling upon any two sutures which are upon the opposite sides of the bowel.

This procedure possesses certain advantages:

- 1 It is extremely simple.
- 2 No special instruments are required. This makes the method just as available in the unexpected emergency as in those cases where resection was anticipated.
- 3 The blood supply to the tissues holding the line of sutures is most carefully conserved. On the other hand, all the tissues to be turned in are not only crushed and devitalized, but deprived of their blood supply, which insures a minimal flange left within the bowel.
- 4 No hemorrhage is incurred during the procedure if it is properly carried out.
- 5 Except for the part to be returned, the bowel is practically untouched by hand, instruments, or sponges during the anastomosis so that peritoneal trauma and the danger of subsequent adhesions is minimal.
- 6 Only interrupted mattress sutures are used, a factor for strength and safety in the anastomosis.

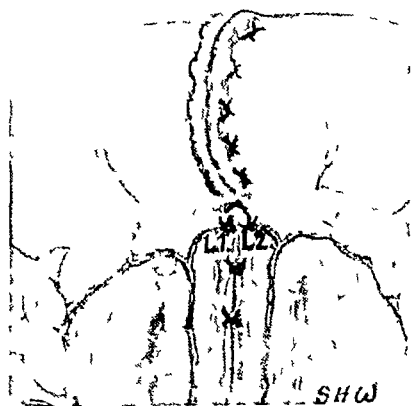


FIG 5—Suture completed. The intestinal lumen has been reestablished by pulling upon two sutures on opposite sides of the bowel.

Intestinal suture by this method has been done twelve times in dogs. Two operations were performed each week for six weeks, at the end of which

ASEPTIC END-TO-END SUTURE OF INTESTINE

time all the animals were sacrificed, following entirely uneventful post-operative courses

In no case was there evidence of leakage at the suture line. In no case was the bowel dilated proximal to the anastomosis. In ten of the cases the omentum, which at time of operation had been placed about the bowel,

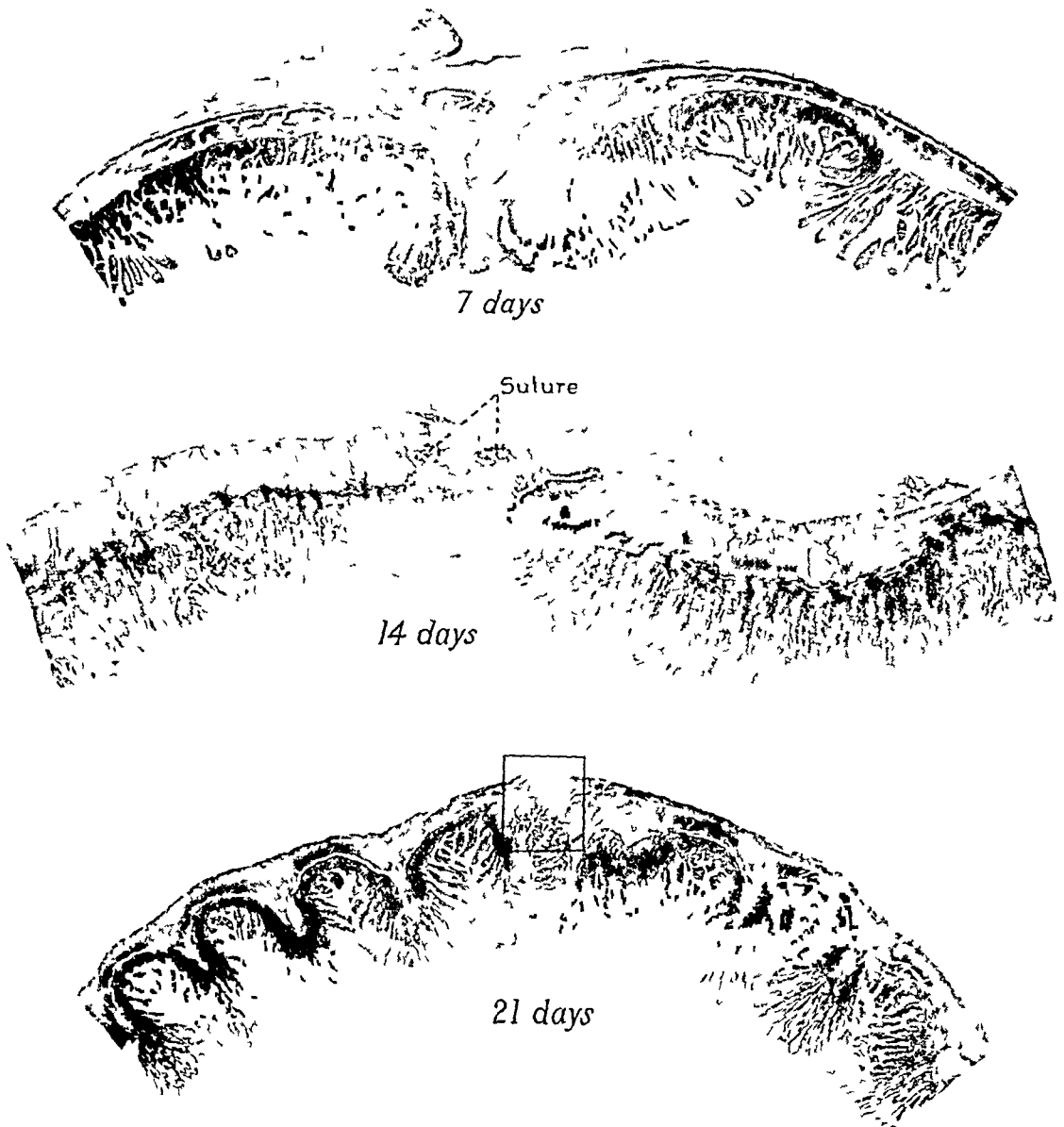


FIG 6 —Three stages in the process of healing. *Upper* Longitudinal section through anastomosis after seven days. Even at this early date practically no flange protrudes into the intestinal lumen, the tissue crushed by the clamps at operation having already sloughed away. A few adhesions are present at the suture line. *Middle* Longitudinal section through anastomosis after fourteen days. There is no flange whatever and the point of union is completely covered with a thin layer of intestinal mucosa. *Lower* Longitudinal section through anastomosis after twenty-one days. Complete repair of the mucosa has occurred. The muscularis has been replaced by connective tissue.

was mildly adherent to the line of suture, in one specimen there were no adhesions whatever, in one specimen the bowel was rather densely adherent to a neighboring loop of bowel.

The involution of the intumed flange is interesting. Even on the seventh day the devitalized portion of the intum has disappeared. On the fourteenth

day the entire flange has flattened out, and low intestinal mucosa has spread across the defect. At the end of twenty-one days the restoration of intestinal mucosa is so complete that careful examination is necessary to determine the exact point of anastomosis (Figs 6 and 7).

The observed fate of the silk sutures is in agreement with the observations of Reichert and Holman. As early as the seventh day, several sutures were

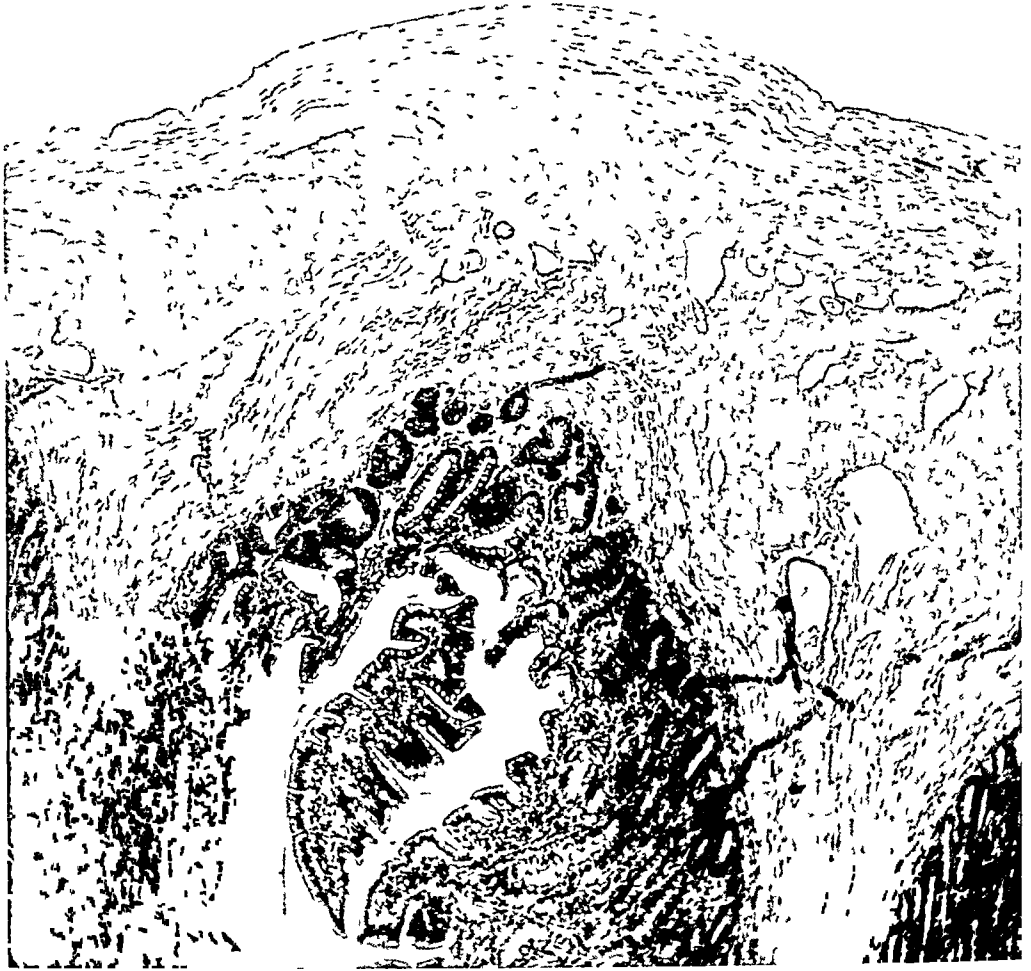


FIG 7.—Microphotograph through the site of anastomosis in the twenty-one days specimen pictured in Fig 6. There is practically no evidence of inflammatory reaction to the operative procedures.

found hanging almost free within the lumen of the intestine but with the knot still buried within the bowel wall. About the third week, small white nodules were found on the outer surface of the bowel beneath the peritoneum composed of fresh granulation tissue containing cast-off silk sutures. In the older specimens this granulation tissue has changed to fibrous tissue and the nodules are smaller. Apparently the inward migration is an earlier process than the outward migration.

The method resembles somewhat the procedures developed by Moszkowicz,⁴ Schoemaker,⁵ Collins,⁶ Pringle,⁷ Parker and Kerr⁸ and

ASEPTIC END-TO-END SUTURE OF INTESTINE

Rostowzew⁹ It differs from each of these, however, in respects, all in the direction of greater technical simplicity

SUMMARY

1 Attention has been directed to the fact that if the walls of a loop of intestine are approximated and strongly crushed in a clamp, they will adhere to each other quite firmly and the intestinal lumen will be occluded after the clamp has been removed

2 This fact has been utilized in the development of an experimental method of aseptic end-to-end suture of intestine

3 This method of anastomosis has been used twelve times with very satisfactory results

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TUBERCULOSIS OF THE CÆCUM*

By JOSEPH W. LARIMORE, M.D.

AND

ARTHUR O. FISHER, M.D.

of St. Louis, Mo.

FROM GASTRO-INTESTINOLOGICAL SERVICE, DEPARTMENT OF SURGERY, WASHINGTON UNIVERSITY MEDICAL SCHOOL

PRIMARY tuberculosis of the intestine in the adult is comparatively rare in this country. Tuberculosis of the intestine, secondary to pulmonary

tuberculosis, is almost as frequent as is the fatal termination of pulmonary tuberculosis. It is a most frequent metastatic complication of pulmonary tuberculosis. Intestinal tuberculosis is seen in from 60 per cent to 90 per cent of cases at termination according to varying autopsy reports. The intestinal involvement centres at the ileo-cæcal segment. So much does this occur it has been stated, without ileo-cæcal involvement there is no intestinal tuberculosis. Exceptions are rare.



FIG. 1.—Barium enema showing tolerance of cæcum to content but with an atypical contour of filling defect and spasm (no palpable mass) an incompetent ileo-cæcal valve and a ragged lumen of proximal appendix (Case I)

Tuberculosis of the intestine differentiates into three pathological forms—the hyperplastic, the fibrous, and the ulcerative. This difference in character

* Read before the Washington University Medical Society, January 12, 1925

TUBERCULOSIS OF THE CÆCUM



FIG 2 —Gastric and duodenal hypotonicity with a tolerant cæcum at the six-hour period in Case II

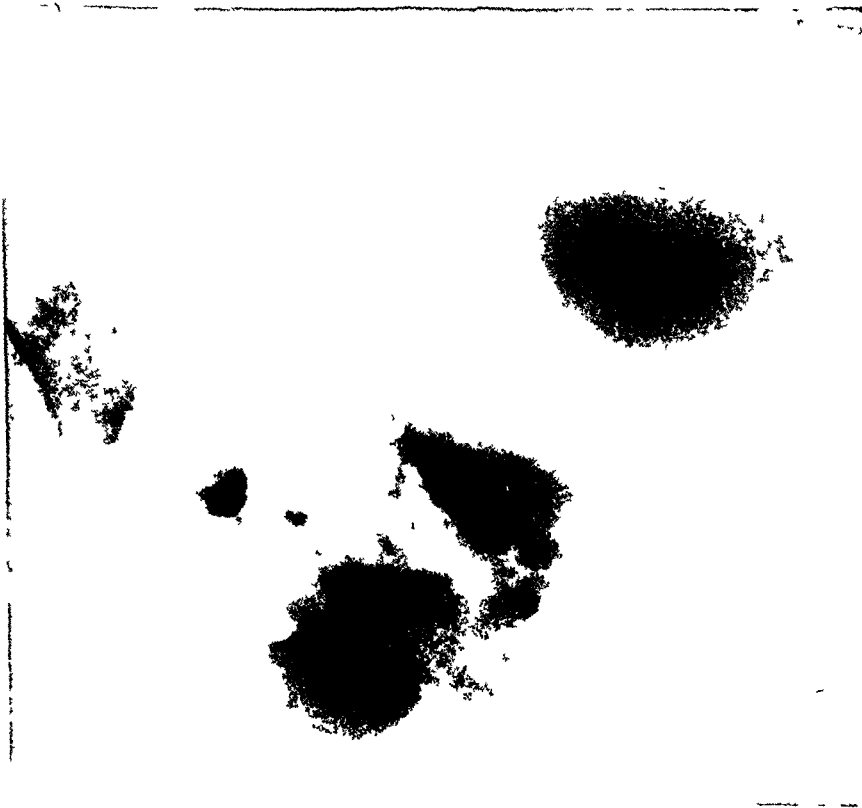


FIG 3 —Case of extensive intestinal tuberculosis, showing at autopsy lesions from the duodenum to the anus. Film taken at ten and one-half hours and shows the gross functional gastric motor insufficiency due to reflex inhibition

is due to the different resultant of the varying virulence of the organism and of the difference in immunity of the patient when the infection takes hold of the intestine. Secondary intestinal tuberculosis is more usually acute and destructive, resulting in ulceration and tending to rapidly involve many segments of the intestine. Primary intestinal tuberculosis tends to remain localized and to be hyperplastic in character. Schwatt,¹ in a very careful study of autopsied cases of pulmonary tuberculosis, states that the onset of secondary intestinal tuberculosis ushers in the termination of the case in from three

to six months. He also states that 50 per cent of secondary intestinal tuberculosis is silent.

The clinical picture of intestinal tuberculosis is not in its early phases conclusive, and it is not in itself diagnostic of that etiology but occurring in the subject of pulmonary tuberculosis it is presumptively certain. In subjects having no obvious or proven tuberculosis the same picture presents a difficult

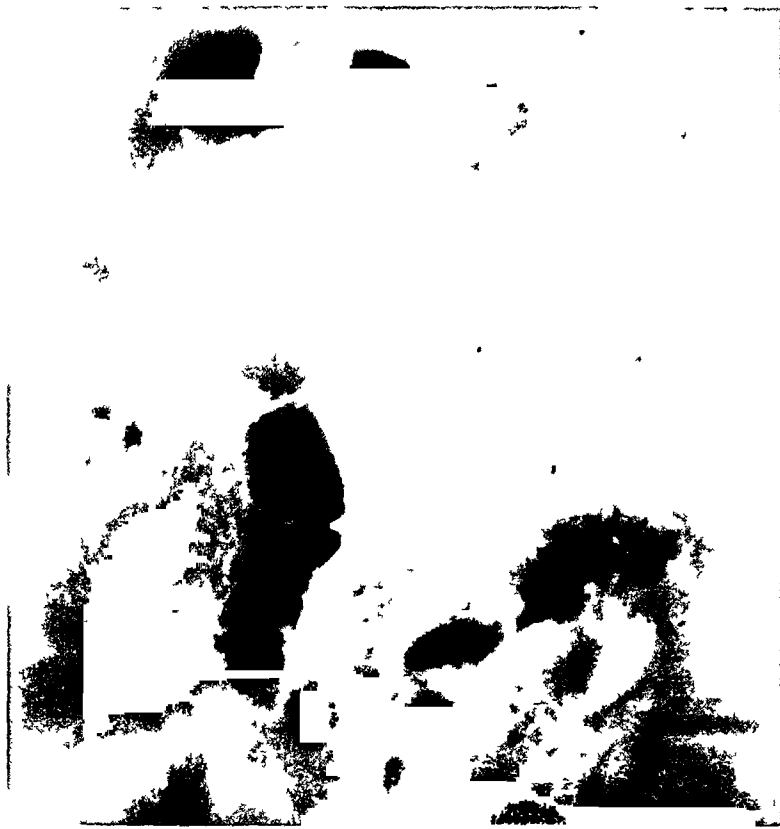


FIG. 4.—Case of advanced localized ileo-caecal tuberculosis showing intolerance of the caecum to barium and a hyper-peristaltic phase of terminal ileum peristalsis.

differential diagnosis from that of malignancy and of syphilis. (See Case VI.)

Clinical symptoms of primary intestinal tuberculosis are chiefly abdominal and, early, are those of partial mechanical obstruction of the intestine. Later the symptoms will be quite characteristic of this. It is not inferred that the obstruction is wholly mechanical. Spasm and disturbed peristalsis may superimpose a functional incomplete ileus. There may be few or no other symptoms of disease. In secondary tuberculosis these same symptoms may occur but the earlier symptoms are those of dyspepsia, fullness, nausea, discomfort, "gas," and anorexia. Vomiting may occur. Fairly characteristic and certain of intestinal involvement in the tuberculous subject is the diffuse pain in the right lower quadrant with "gas" or cramps, and fullness associated, soon after meals. Tenderness to palpation, rigidity of the abdominal wall, or a

TUBERCULOSIS OF THE CÆCUM

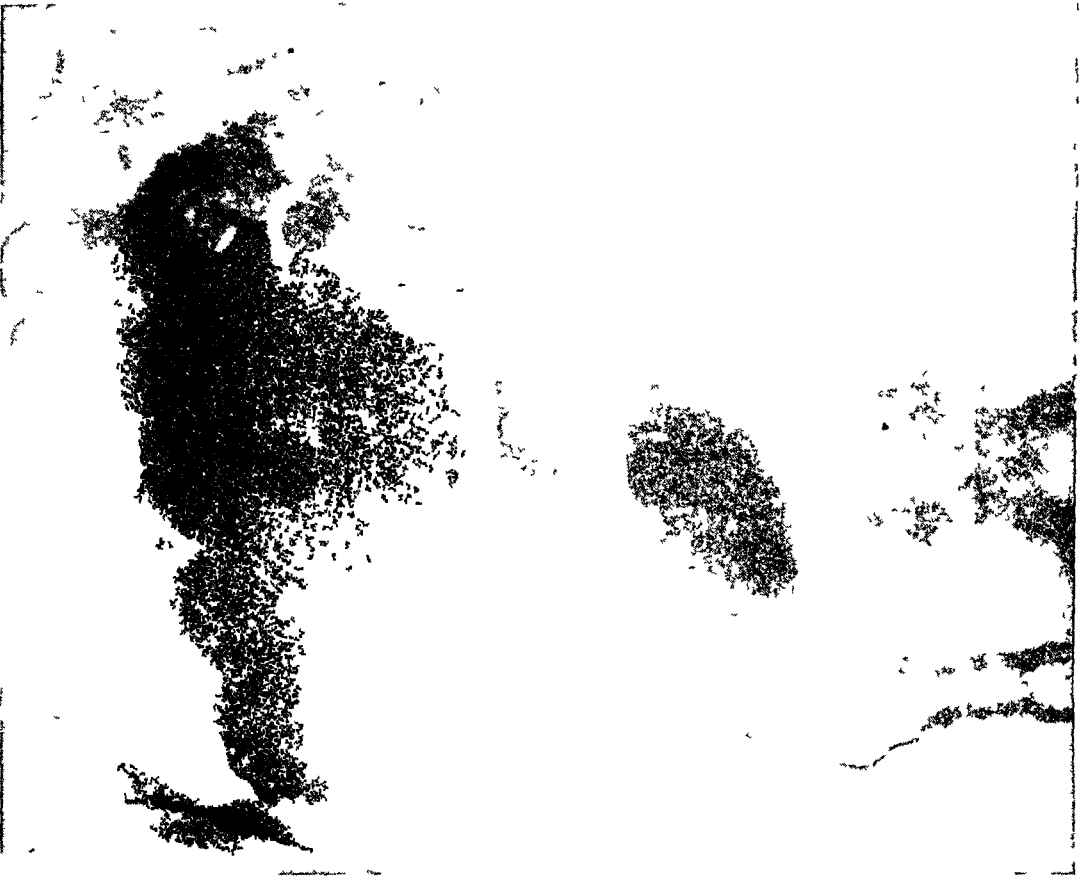


FIG 5.—Observation of fed test at the six-hour period in Case IV suggesting cecal intubation which was demonstrated subsequently by fluoroscopic palpation. The gastric motor delay and relative colonic hypermotility support these suggestions.



FIG 6.—Barium enema in a case of advanced cecal tuberculosis demonstrating the intubation of the cecum. The barium can be passed through and into the small intestine but is not retained sufficiently long in the cecum to appear in the picture.

palpable mass may be found but are usually late occurrences. The status of bowel function may suggest intestinal involvement, the change of constipation to regular action without medical means, or the onset of a greater or lesser grade of diarrhoea. Diarrhoea is a late symptom and results from the irritation hyperperistalsis and later from the interference with the water-absorbing



FIG 7—Caecum in Case I observed filled and retentive at the six hour period prior to any palpation

function of the bowel when generally involved. Localized tuberculosis of the caecum permits normal total mobility of the colon.

The relation of the intestinal involvement as a determining cause to the fatal termination is problematic. It is certain that it occurs as a terminal incident in otherwise fatal pulmonary tuberculosis. It is also apparent that it occurs as a determining fatal complication in cases which are retrogressive as regards the pulmonary disease.

In these cases it

operates, first by superimposing an overload on the immunity and thus exhausting the resistance of the patient and secondly by creating localized and reflex functional gastro-intestinal derangements which impair the total alimentary function and general nutrition. It is for the relief of these factors that surgery may be considered.

An early diagnosis of secondary tuberculosis of the intestine is essential to helpful surgical interference. The ileo-caecal region only is involved in about 29 per cent of the cases seen at autopsy. It is probable that of the 60 per cent to 90 per cent of cases which terminally show extensive intestinal

TUBERCULOSIS OF THE CÆCUM

Fig 8—Cæcum in Case I as observed after palpation which initiated peristalsis and spasm



Fig 9—Case having only chronic appendicitis (operative confirmation) but with distribution of barium at 24 hours suggestive of pathological ecto-colic intolerance. Subsequent examination demonstrated an absence of irritability or other change in cæcum. It could not by palpation be caused to empty



involvement, a larger proportion at some anti-mortem period will show a localized ileo-cæcal involvement which would permit of surgical interference

Secondary intestinal tuberculosis to X-ray observation shows alterations of the intestinal contour by filling defects and spasms (Fig 1) and associated disturbances of alimentary motility. Early secondary tuberculosis may be localized in the ileo-cæcal segment. The associated direct and reflex derange-

ments of gastro-intestinal function as revealed by X-ray study are variable. There appears marked gastric motor delay (Fig 2) with gastric hypotonicity (Fig 2), total intestinal hypermotility with complete evacuation of barium in from eighteen to twenty-four hours or with barium in the distal colon or rectum at six hours in spite of a gastric motor delay the result of cæco-colic hypermotility. Gastric motility may be almost completely inhibited (Fig 3). The



FIG 10.—Case with small intestinal hypomotility at six hours demonstrating failure of any clearance into the cæcum although the stomach has emptied. Recoil is shown in the loops of the ileum.

principal sign of ileo-cæcal or cæco-colic tuberculosis is the progressively increasing intolerance of the cæcum to any content which makes it non-retentive of barium (Fig 4). In the late cases with extensive ulceration this is readily demonstrated by any fed test (Fig 5) or by barium enema (Fig 6) and has been the classical sign of ileo-cæcal tuberculosis, as independently observed by Pirie,² and by Stierlin,³ whose name it bears. An earlier phase of this intolerance was demonstrated in our ulcerative cases by fluoroscopic observation and palpation. The irritability of the cæcum at this very early stage, when its intolerance of barium is not so

TUBERCULOSIS OF THE CÆCUM

constant and absolute, can be demonstrated with fluoroscopic palpation. Palpation in these cases will, if the cæcum contains any barium, cause the cæcum and the ascending colon to promptly empty distally (Figs 7 and 8). The observation is confirmatory of irritability when the cæco-colon will still show a retention of barium. When the cæcum is casually empty (Fig 9) it will in further study negative the suggestions of involvement. I have in all cases secured, by palpation, peristalsis in the terminal ileum resulting in its clearance into

the empty and relaxed cæcum which then with the ascending colon contracts and propels the barium mass distally. The cæco-colon then remains in spasm. Further peristalsis of the ileum cannot soon be elicited. This inhibition in the ileum may explain the frequent observation of a failure of small intestinal clearance (hypomotility) into the cæcum at the six-hour

period (Fig 10), although

obstruction does not exist. Emptying of the cæcum following its palpation I have observed in other than these cases of ileo-cæcal tuberculosis in only one instance, although palpation to determine cæcal mobility and appendiceal tenderness is a routine manœuvre. Emptying was elicited in this exception only after unusually extended palpation. The case was one of a large retro-peritoneal sarcoma in the right iliac fossa which had raised and displaced the cæcum to the left (Fig 11). X-ray and clinical evidence of pulmonary tuberculosis (Fig 12) contributed to the possibility of the abdominal lesion being tuberculosis. Resolution of the mass after deep Rontgen therapy supported the diagnosis of sarcoma which was not shown conclusively by the microscopical section.



FIG 11 —Barium enema in a case of retro-peritoneal sarcoma showing displacement of the cæcum and its relative intolerance to content the only case other than those of tuberculosis to give the reaction of irritation

The demonstration in these five cases of an early localized ileo-cæcal involvement was supported by a lack of any X-ray evidence of other intestinal involvement which would have contra-indicated surgery. In these cases the diagnosis of intestinal involvement was clinically indeterminate. It was determined by the X-ray study. When intestinal involvement has become clinically certain the pathology has usually advanced beyond the possibility of the surgical removal of the diseased segment of bowel.

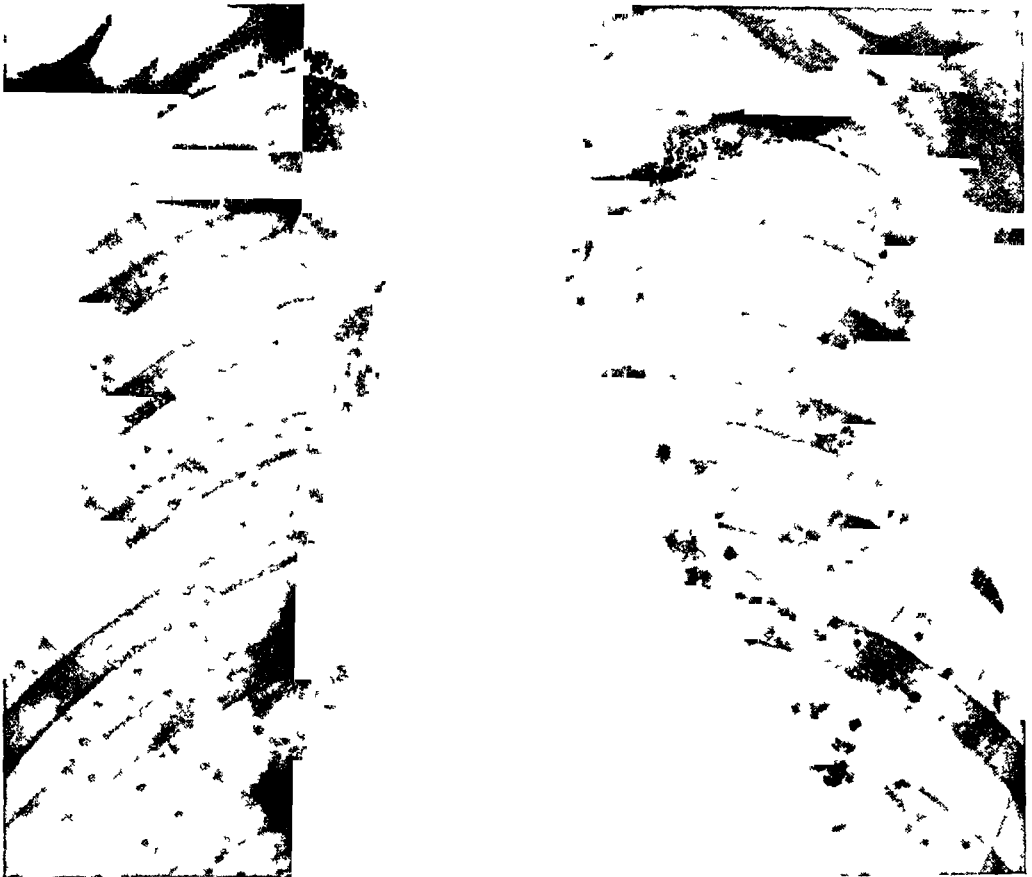


FIG. 12—Chest film of same case as Fig. 11 showing evidence of healed pulmonary tuberculosis, and there were present clinical signs of activity.

CLINICAL RECORDS

CASE I—G. C. W., white, female, single, aged nineteen years, had been a patient at the St. Louis Koch Hospital for Tuberculosis for the previous several months and at the time of admission to our service showed an advanced but retrogressive pulmonary tuberculosis with extensive involvement of both upper lobes (Fig. 13). For the preceding two months she had complained of slight cramping in the lower abdomen, more especially to the right, following meals. She had had some vomiting, however, always induced by coughing. There was slight, diffuse tenderness to palpation in the right lower quadrant without palpable mass. There was no rigidity.

X-ray examination showed a functional gastric motor insufficiency with a very small amount in the stomach at six hours. There was hypermotility of the proximal colon (Fig. 14). The cæcum had an atypical form with a narrow irregular contour, showing a constriction at juncture of the cæcum and the ascending colon, definitely pathological.

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(Fig 15) The cæcum was intolerant to barium, in that, although initially filled, peristalsis was elicited after extended palpation, and coincident with large clearance from the terminal ileum (Figs 7 and 8) The peristalsis was slow, and emptied the cæcum into the ascending and the proximal transverse colons The ileo-cæcal valve was incompetent The valve was well opened by hyperperistalsis of the terminal ileum The lack of clearance at six hours from the terminal ileum (total small intestinal hypermotility) in the initial examination, and only slight clearance on duplicate examination was due to reflex inhibition of the ileum The cæcum and the terminal ileum were freely



FIG 13 —Chest showing pulmonary status of Case I at the time of operation

movable The appendix was visualized, filled in proximal portion only and palpable even in its unbariumized portion, with marked tenderness coinciding

Conclusion (of X-ray examination) X-ray findings were conclusive of pathological involvement of the cæcum, the terminal ileum and the appendix, presumptively by tuberculous ulceration Involvement of the ascending and proximal transverse colons was highly suggested but not conclusive There was no extra-alimentary extension, and the conditions permit of surgical interference for resection

Operation, August 11 1924 *Resection of cæcum* (Dr A O Fisher) Under twilight and local anaesthesia, right rectus incision through the muscle No free fluid in the peritoneal cavity The cæcum was readily delivered The entire appendix was thick indurated and stiff—typical of tuberculosis This induration involved the cæcum which was also markedly thickened The mesentery contained much fat and numerous glands The abnormal condition of the cæcum apparently extended up to the hepatic

flexure and resection was decided upon. The terminal three or four inches of the ileum, the cæcum and a portion of the ascending colon liberated and removed in the usual manner, cut ends turned in and lateral anastomosis performed. There was practically no soiling and no bleeding. A rubber tissue drain was placed between the peritoneum and muscle. Wound closed in layers. Nitrous oxide given after resection was begun.

Gross pathology (Dr I. Y. Olch). The material (Figs 16 and 17) consisted of a cæcum and an appendix. The walls were not thickened. Upon opening, the mucosa presented a moth-eaten appearance. It seemed to be converted into many small confluent



FIG 14.—Observation at the 24 hour period (Case I) showing total colonic motor delay with proximal colonic hypermotility suggestive of cæcal irritability which was subsequently demonstrated (Figs 7 and 8)

ulcers. No normal mucosa was seen, there were many small white areas which resembled small tubercles.

Microscopic pathology (Doctor Olch). Sections showed areas of ulceration. The mucosa was greatly infiltrated with round cells and eosinophiles. The submucosa was greatly thickened and also infiltrated with these cells. There were typical tubercles throughout the submucosa. Some contained giant cells and many giant cells were seen throughout the submucosa. Section of the appendix showed merely a round-cell infiltration of the submucosa. A lymph-node contained several typical tubercles and giant cells.

The post-operative course was uneventful. There was a transient slight but definite exacerbation in the pulmonary conditions. Subsequent gastro-intestinal function has been excellent on full regular diet including fruits and vegetables. Twelve months after the operation the patient is still under treatment at the Koch Hospital and is markedly improved as to pulmonary status.

TUBERCULOSIS OF THE CÆCUM

CASE II—A M O'C, white, female, single, aged twenty-seven years The patient entered our service from her home, being referred by Dr J F Brdeck from his private practice She had been under treatment for one year with bed rest, only partial during later months, since the pulmonary condition was retrogressive At this time the pulmonary condition was stationary with right, partial artificial pneumothorax (Fig 18) The gastro-intestinal complaints were not characteristic of alimentary involvement—vomiting occurred frequently, and there was a soreness in the right lower abdominal quadrant There was no diarrhoea Physical examination showed only slight diffuse tenderness in the right lower abdomen

X-ray examination showed gastric hypotonicity (Fig 19) and a functional gastric motor insufficiency (Fig 2), colonic hypermotility and atypical filling of the cæcum at six hours (fed test) with inadequate filling by barium enema The appendix was not visualized

Operation *Resection of the cæcum* (Dr A O Fisher) Under twilight anaesthesia and gas, right rectus incision through the muscle There was no free fluid in the peritoneal cavity and the parietal peritoneum was not involved The liver was displaced downward, the edge being below the level of the umbilicus, but its appearance was normal The transverse colon was delivered and followed down to the region of the cæcum, which was also delivered without difficulty The cæcum and most of the ascending colon, together with the appendix and terminal ileum, were involved in an inflammatory process which was limited to this region The



FIG 15—Specimen as removed from Case I and yet unopened

bowel was stiff and mottled and presented the typical appearance of tuberculosis The glands in the ileocecal region were enlarged but not broken down The cæcum, most of the ascending colon, and the terminal three or four inches of the ileum were resected The ends were turned in and a lateral anastomosis was made between the ileum and the transverse colon There was very little bleeding and practically no soiling The wound was closed in layers and a small rubber tissue drain inserted between the muscle and the peritoneum The patient stood the operation very well and was awake before leaving the table

Gross Pathology (Dr I Y Olch) The material (Fig 20) consisted of a cæcum with appendix and the end of the ileum The walls were generally thickened The mucosa was missing in patches, giving a moth-eaten appearance without definite delineated ulcer Upon section the cut surface through the involved area did not show gross tuberculosis and this was probably an old or partially healed process

Microscopic pathology (Doctor Olch) All sections showed the same picture



FIG 16 —Specimen of Case I opened

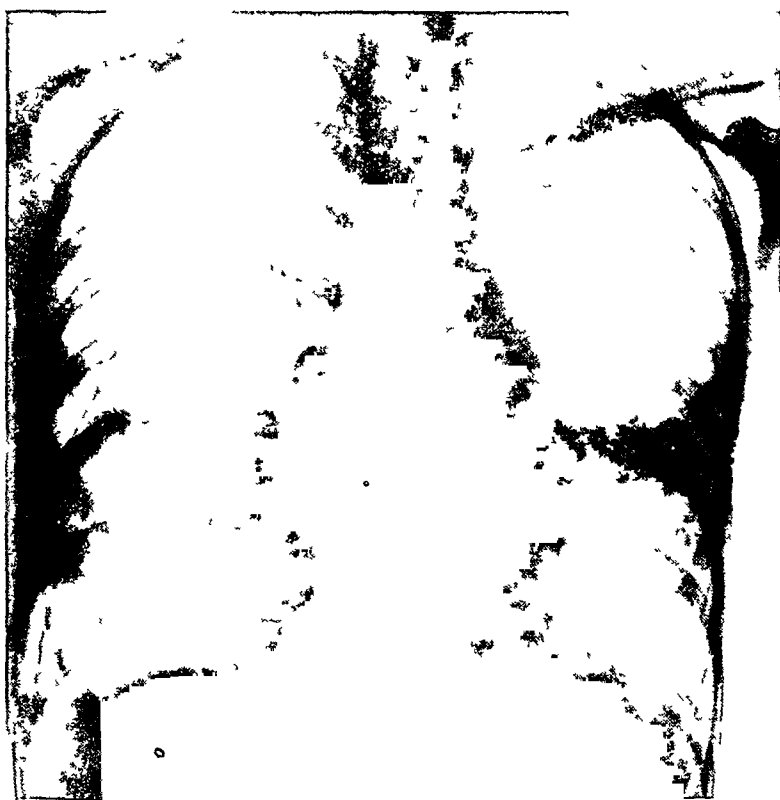


FIG 17 —Showing pulmonary status with partial right pneumothorax existing in Case II at the time of operation

TUBERCULOSIS OF THE CÆCUM

The submucosa and the muscularis of the colon wall were greatly thickened. The mucosa was replaced in places by active granulation tissue. The wall was greatly infiltrated with round wandering and plasma cells and a large number of polymorphonuclear cells. In one section a nodule resembling a tubercle was seen, but was very atypical. No amœbæ were seen.

The patient's post-operative course was uneventful and before leaving the hospital she had taken for two weeks a full diet, including cooked fruits and vegetables, with excellent gastro-intestinal function and improvement of nutrition. This continued after she returned home. There was, however, an increase in pulmonary signs. She died six weeks after leaving the hospital. There was much vomiting during the last day, but abdominal examination was not notable for any sign suggesting post-operative complication.

CASE III—A S., white, female, single, aged twenty-two years, had been a patient at the St. Louis Koch Hospital for Tuberculosis the previous seven months and at the time of admission to our service showed a far-advanced pulmonary tuberculosis with a cavity in the left apex and also in the lower lobe (Fig 21). The sputum showed acid-fast bacilli. The

pulmonary condition was progressive at this time. For the previous two months she had persistently complained of abdominal cramps, belching and sour stomach and frequent nausea. More recently there had been tenderness to palpation in the right lower abdominal quadrant but without palpable mass.

X-ray examination showed gastric motility to be adequate in the six-hour period. The total colonic motility was over-prompt. The cæcum was relatively intolerant to barium but held sufficiently to secure a film (Fig 22) by barium enema. This showed a ragged irritation contour of the cæcum and the ascending colon characteristic of an ulcerative colitis. Pathological changes cease at the hepatic flexure, and the colon distally shows normal contour. Fluoroscopically the reaction is characteristic of an ulcerative lesion. Initially there was very scant barium in the cæcum, but during the observation the terminal ileum emptied, and the cæcum immediately and promptly projected the barium mass distally, and it was carried promptly into the distal transverse colon. This reaction followed promptly a clearance from the terminal ileum. Slight palpation of the cæcum and the terminal ileum had immediately proceeded. Tenderness was greatest

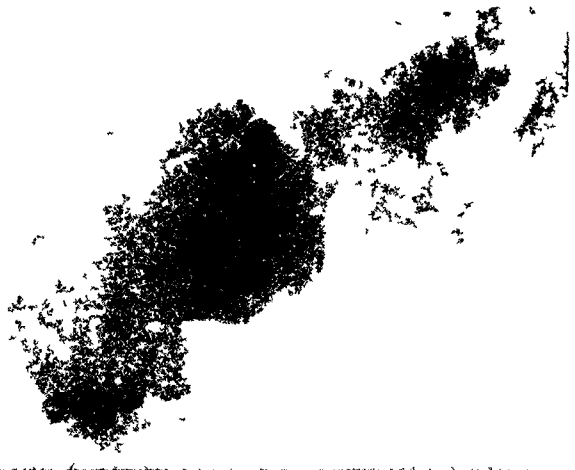


FIG 18—Observation at the 24 hour period (Case II) showing proximal colonic hypermotility not evidenced at six hours (Fig 2) and subsequently demonstrated by reaction to palpation to be due to cæcal irritability.

to direct palpation of the cæcum. The ileo-cæcal valve was incompetent. The appendix was not visualized and is probably involved in ileo-cæcal pathology. The cæcum was movable.

Conclusion (of X-ray examination) Pathology is limited to the cæcum and the ascending colon and the appendix, and is probably of tuberculous origin. Involvement is sufficiently localized and early to permit local surgical interference for resection and anastomosis.

Operation *Resection of the cæcum* (Dr. A. O. Fisher) Under twilight and gas anæsthesia, a right rectus incision was made through the muscle. No free fluid in the peritoneal cavity. The cæcum was injected and covered with fibrin, the appendix was a large, thick, fibrous structure suggestive of tuberculosis, the wall of the cæcum was also thickened and indurated. This induration extended almost to the hepatic flexure. At this point the omentum was densely adherent to it. It was easy to mobilize the cæcum and resection was done. The lower three to four inches of the terminal ileum, the cæcum and the ascending colon were removed, although there was no evidence of disease in the ileum. The cut ends were turned in with double purse-string sutures, reinforced later with continuous silk sutures. Numerous enlarged glands were present but all were soft. The raw surface left on removal of intestine was covered with peritoneum. Side-to-side anastomosis was then done between the terminal ileum and the large intestine using two layers of catgut. The end of the large bowel was covered with omentum and the two loose ends of intestine anchored to the adjacent bowel. An adequate stoma was



FIG. 19.—Opened specimen of resected cæcum from Case II

left and there was practically no soiling during the operation. At this point the entire team changed gowns and gloves. The abdominal wound was closed in layers without drainage. The patient was carried on gas except for a short period when the cæcum was being resected, during which time she had about two ounces of ether. She left the table in good condition.

Gross pathology (Dr. I. Y. Olch) The material consisted of the cæcum and the appendix and the terminal ileum. Around the ileo-cæcal valve were several small patches where the mucosa was missing, leaving small ulcers which were irregular and had a moth-eaten appearance. Several of these ulcers were found in the lower portion of the cæcum. The ileum was normal. The appendix was 8 cm long, thickened, and its

TUBERCULOSIS OF THE CÆCUM

mucous membrane was dark and injected. Several lymph-nodes were enlarged. The mucosa and muscularis were thickened and more or less injected.

Microscopic pathology (Doctor Olch). Section showed a small area where the mucosa was missing and replaced by granulation tissue. The submucosa was thickened generally and there was marked round-cell infiltration throughout all layers. Here and there in the submucosa were seen several small tubercles. Lymph-nodes showed several small tubercles, each containing giant cells.

CASE IV—M. H. S., white, female, single, aged twenty-two years. The patient entered our service from her home, being referred by Dr. J. F. Bredeck from his

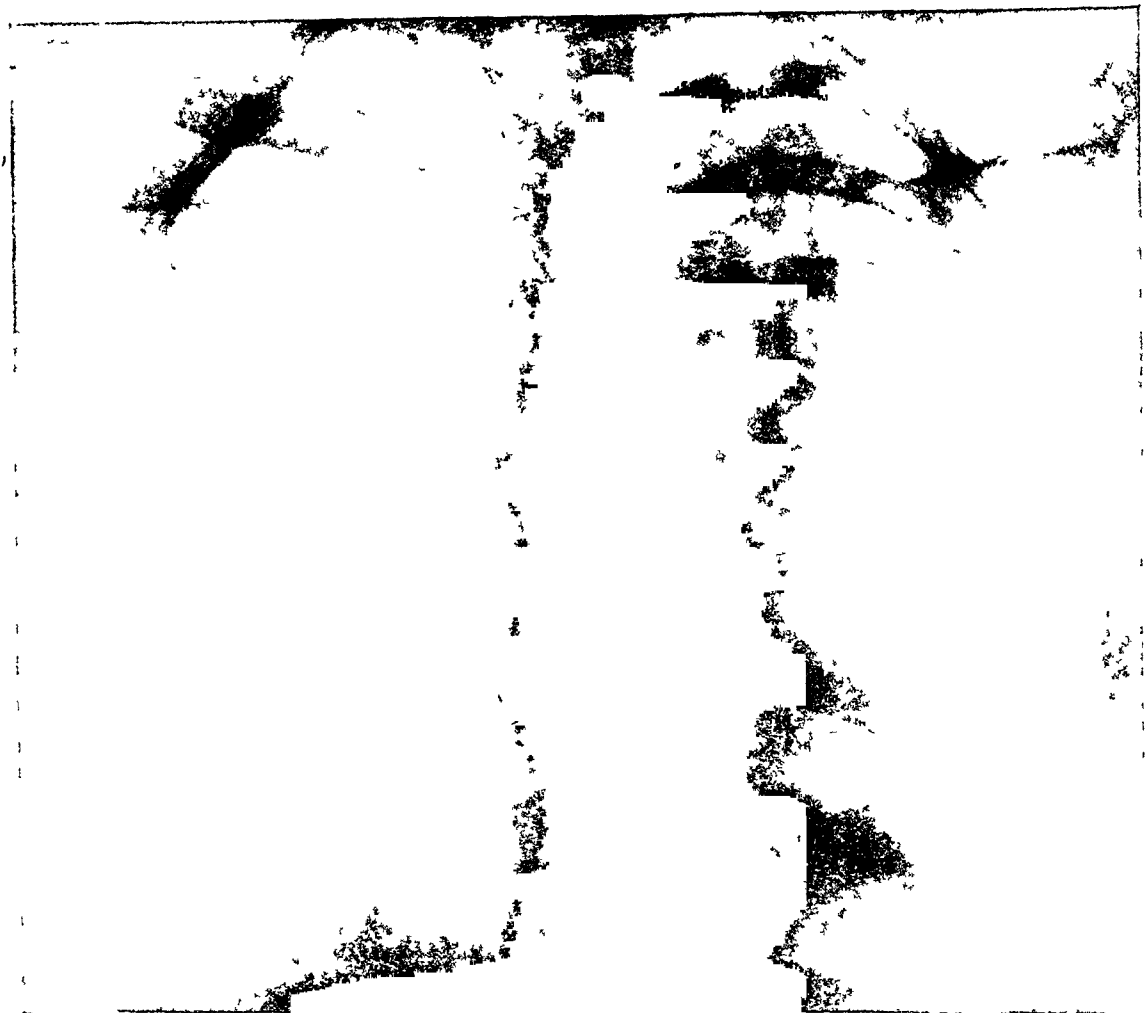


FIG. 20.—Chest showing pulmonary status at the time of operation in Case III.

private practice. She had been under treatment with complete bed rest for eighteen months. The pulmonary condition was stationary with complete involvement of the left lung (Fig. 23). The gastro-intestinal symptoms were wholly of the character of a secondary dyspepsia with a chief complaint of nausea without vomiting. There was no pain or diarrhoea. No abdominal mass or tenderness could be found.

X-ray examination showed the stomach hypotonic with, however, normal total motility (empty within six hours). The pyloric ring was patulous and incompetent. The duodenum was generally hypotonic. The appendix was not visualized and had no local tenderness. The reaction of the cæcum to palpation was highly suggestive of pathology. The cæcum and the proximal colon showed hypermotility (Fig. 5), however, the cæcum filled well and retained barium in the barium enema. The cæcum was noted in the fluoroscopic examination in hyperperistaltic movement initiated by a large clearance from the terminal ileum, which was immediately passed into the distal transverse colon.

and the cæco-colon then persisted in spastic contraction. There was no tenderness associated with palpation of the cæcum. There was marked colonic hypermotility associated with a rectal residual constipation.

Operation Resection of the cæcum (Dr A O Fisher) Under twilight and local anæsthesia, incision was made through the right rectus muscle. The peritoneum was not involved. There was no free fluid. The cæcum was readily delivered. The appendix was greatly thickened, mottled, and was typical of a tuberculous process. The cæcum was likewise thickened. The terminal ileum was normal. The mesenteric glands

were definitely palpable but not greatly enlarged or caseous. The mesentery was divided, but this could not be done without causing a considerable amount of pain, so that she was given gas from this point on and took it nicely. The cæcum and the terminal ileum were mobilized without difficulty and excised. The ends were turned in with double sutures and a lateral anastomosis was made between the ileum and the ascending colon. The entire operation was done outside the peritoneal cavity so that there was practically no soiling. After the anastomosis was finished, gowns, gloves, instruments and linen were changed in order to prevent any soiling of the wound. The wound



FIG. 21.—Barium enema in Case III demonstrating tolerance of the cæcum which has an equivocal contour. Irritability of the cæcum was demonstrated by palpation when it filled in the fed test.

was closed without drainage, except for a small rubber tissue drain placed between the peritoneum and rectus muscle. The patient stood the operation remarkably well and left the table in excellent condition. She was awake on reaching the ward.

Gross pathology (Dr I Y Olch) The material (Figs 24 and 25) consisted of a cæcum, the ileo-cæcal junction and the appendix. The mucosa was intact, but at one place in the cæcum the tissue felt rather firm. The appendix was greatly thickened, 5 cm long and appeared pathological. The end of the ileum was normal. One large lymph-node (1.5 cm) at the ileo-cæcal junction.

Microscopic pathology (Doctor Olch) Sections of the colon and the ileum showed the mucosa intact with the exception of one small area where it was eroded.

In this area of erosion and undermining of the adjacent mucosa there were great numbers of lymphocytes. In several places small tubercles were seen, in the centre of each was one or more giant cells. Section of the appendix showed the submucosa and wall thickened and greatly infiltrated with round cells in one place beneath the mucosa was a tubercle with three giant cells.

This patient had an uneventful post-operative course, with excellent healing of the wound. Subsequent gastro-intestinal function was excellent and symptomless. Doctor Bredeck stated that all problems of alimentation were corrected by the operation. There was a slow progression of the pulmonary disease and the patient died eight months after the operation.

CASE V—E. C., white, female, single, aged twenty years. The patient entered our service from her home, where she had been treated for proven pulmonary tuberculosis (Fig 26), with bed rest for nine months under the care of Dr. S. B. Grant. She had had in the preceding four months four bowel actions daily and cramps ("gas") in the lower abdomen following all meals. Vomiting occurred only when induced by coughing. She

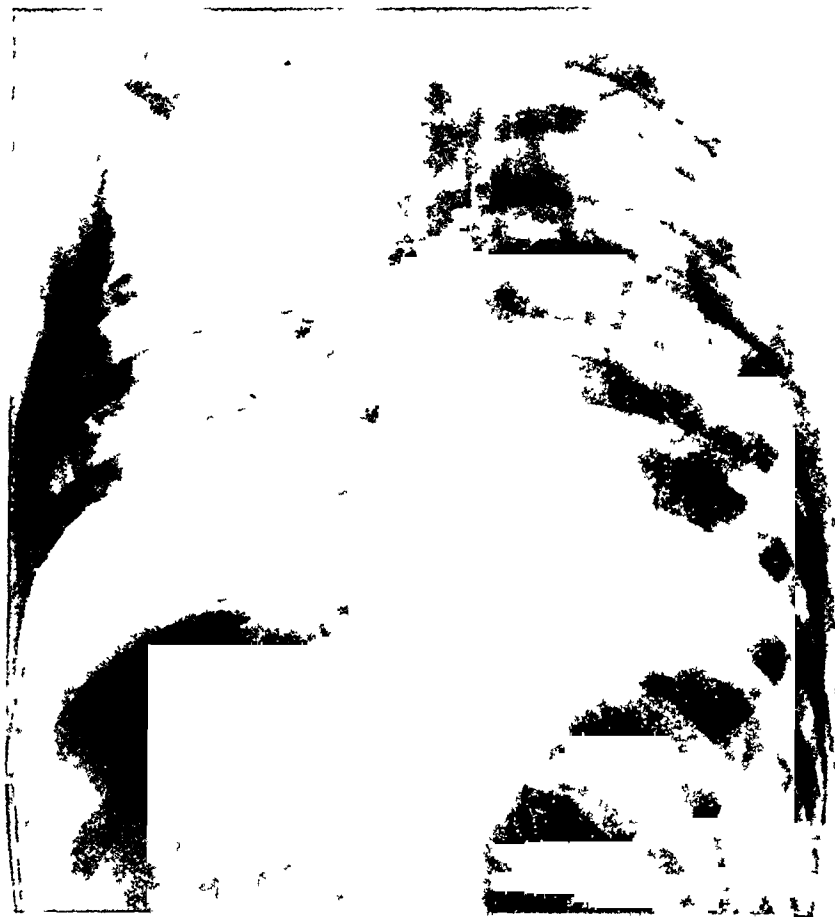


FIG. 22—Chest showing pulmonary status in Case IV at the time of operation.

had artificial pneumothorax established prior to operation. This case died suddenly five days post-operative from cardio-respiratory complication.

X-ray examination showed adequate gastric motility. There was colonic hypermotility with almost complete evacuation of barium at eight hours and the cæcum showed hyperirritability. There was tenderness to pressure over the cæcum and the terminal ileum greater over the latter. The terminal ileum was freely movable and the cæcum was slightly fixed. The cæcum was tolerant to barium enema (Fig 27). In special examination, vigorous palpation resulted in the emptying of the terminal ileum into the cæcum and then cæcal contraction with projection distally of its barium mass (Figs 28 and 29). This reaction is characteristic of cæcal involvement of the ulcerative type. The ileo-cæcal valve was incompetent. The appendix was not visualized.

Operation. Resection of cæco-colon (Dr. A. O. Fisher). Right rectus incision through the muscle. Fair layer of fat in abdominal wall. Plenty of fat throughout peritoneal cavity in mesentery and omentum. No free fluid. The appendix was found to be a thick, indurated, cedematous structure considerably enlarged, and had the mottled grayish appearance which is suggestive of tuberculosis. The cæcum was markedly

thickened and the mesentery was adherent to its outer surface. This process extended up to the hepatic flexure. The remaining large bowel seemed normal. The glands were not definitely enlarged. A few were removed for examination. The terminal ileum was negative. The cæcum with a few inches of terminal ileum and most of the ascending colon were resected. The ends were turned in with double catgut sutures reinforced with silk, and a lateral anastomosis made between the ileum and the transverse colon. There was very little soiling and after the anastomosis there was a complete change of instruments, gloves and gowns. Wound closed in layers without drainage. Patient stood operation very well.

Specimen was examined immediately after operation and on opening it there were many definite small irregular ulcers in the wall of the cæcum and in all probability some



FIG. 23.—Specimen of resected cæcum unopened from Case IV

of the involved cæcum was left behind. It was difficult to tell by palpation just how far up these lesions extended and to know, therefore, how much to take away. It was noted in this case, however, that the omentum was adherent to the bowel over the entire area which was removed and somewhat beyond it. It is possible that this may be helpful in determining the extent of the lesion.

Gross pathology (Dr. I. Y. Olch.) The mater-

ial consisted of a cæcum with about 7 cm. of the ascending colon and about 3 cm. of the terminal ileum. The appendix was 6 cm. long and thickened. On the serosa of the cæcum there was a rather diffuse white scarring. The wall of the gut was everywhere thickened. The mucosa of the ileum and the ileo-cæcal valve were normal. On the mucosa of the ileum were several irregular, shallow ulcers each with a necrotic base. The appendix also contained these ulcers.

Microscopic pathology (Doctor Olch.) Sections showed intestine in which the mucosa was missing in places, especially between the folds. The submucosa was thickened and infiltrated with many round cells, and showed many tubercles containing one or more giant cells. The process here evidently started in the submucosa and extended later to the mucosa and the muscularis.

In contrast to the five operated cases of secondary early ulcerative cæcal involvement is the following case of early primary tuberculoma of the cæcum.

CASE VI.—P. J. R., colored, male, married, aged twenty-four years. Patient entered Barnes Hospital from the out-patient department with a diagnosis of chronic appendicitis. He had had for six months a constant, dull ache in the right lower quadrant varying somewhat in degree. Treatment and attention to the bowels had been without influence. Physical examination showed a palpable mass the size of a large lemon, freely movable,

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firm and moderately tender. The lungs were not notable by physical examination or X-ray (Fig 31). There was a slight afternoon temperature.

X-ray examination showed a gross filling defect of the distal cæcum and the proximal ascending colon and coinciding with the palpable mass in the lower right quadrant and accompanied by hypermotility of the cæcum. The tumor may be neoplastic or inflammatory. The general contour, consistency and tenderness were more suggestive of adenoma, however, the same picture could be produced by chronic inflammatory disease—tuberculosis or leuc. Tuberculosis was suggested by the hypermotility of the distal cæcum. There was stasis in the terminal cæcum. The appendix was visualized, poorly filled and showing contracted lumen. Conclusion: Tumor of the cæcum with evidence in favor of a neoplasm. Situation: one requiring operative interference.

Operation: *Resection of the cæcum*. (Dr A. O. Fisher.) A right rectus incision through the muscle. There was no free fluid. The cæcum was edematous and the seat of an extensive tuberculous process which involved the entire head of the cæcum, one-half of the ascending colon, the ileo-cæcal valve and the terminal ileum. Numerous masses of retroperitoneal glands were felt throughout the peritoneal cavity. There were several very large glands lying in the angle between the ileum and the cæcum. One of these was quite soft and caseous and was broken



FIG. 24.—Same specimen as in Fig. 23 opened. (Case IV.)

into in our manipulation. There was no evident involvement of the parietal peritoneum. It was thought advisable to resect the tuberculous cæcum in the first place to prevent occlusion which would probably follow *before long* and to eliminate the supposed primary focus. The cæcum was mobilized without much difficulty. Practically the entire ascending colon with the cæcum and with about 10 cm. of the terminal ileum were removed in one mass. The ends were turned in and a lateral anastomosis was made between the terminal ileum and the transverse colon. There was relatively slight soiling. Wound closed without drainage except for a small rubber tissue drain between the peritoneum and the muscle.

Microscopic pathology. (Dr I. Y. Olch.) All sections showed intestinal wall, the mucosa of which was fairly intact. The submucosa and muscularis were greatly infiltrated with vast numbers of lymphocytes, wandering cells and some eosinophiles. Many typical tubercles were seen with many giant cells.

This patient had an uneventful post-operative course and was promptly discharged from the hospital. Post-operative examination had shown excellent anatomical and functional conditions and the patient is pursuing a normal life with heavy work.

DISCUSSION

The involvement of the intestine secondary to pulmonary tuberculosis constitutes a major handicap to treatment of the primary disease. Medical management of the intestinal complication must, as its first measure, adjust the diet in a manner as to inevitably limit rather than increase total nutrition,



FIG. 25 —Chest showing pulmonary status at the time of operation in Case V

even in the earliest stages of the intestinal involvement. Symptoms in the later stages obviate even adequate nutrition and in themselves so exhaust the patient as to hasten if not induce the fatal termination. It is not surprising that an absolutely unfavorable prognosis should be claimed in the presence of this complication. In our observations at the St. Louis Koch Hospital for Tuberculosis there has appeared no method of treatment or other reason to demur from that position. Heliotherapy has not yet yielded for us the curative results as reported by others. In those cases in which we could determine favorable early intestinal localization of the disease, we have had no hesitancy in offering the patients the chance to improve their general prognosis by surgical interference. Always they have been told of the full immediate surgical risk and of the nature of the procedure as remedial to a complication. The cases that have so far come to our observation have had far advanced

pulmonary disease and the greater number could not be considered as subjects for surgery. Of the five cases operated none could be given a good prognosis for their pulmonary status alone. Cases in which the pulmonary status may be so favorable as to justify urging a recourse to surgery will be infrequent. Of our five operated cases, one is living after one year and improving and is without gastro-intestinal symptoms, one died post-operatively in the hospital and three died after leaving the hospital. These three until the terminal period gave no further gastro-intestinal symptoms.

The diagnosis has been established in these five cases at a very early period of the intestinal disease when the operation could be directed to removal of the disease rather than to palliation of an urgent symptom. The evidence of gross pathology in the bowel before its resection and



FIG. 26.—Barium enema in Case V giving no suggestion of pathological involvement of the cecum. Irritability of the cecum was demonstrated by palpation in the fed test. (Figs. 27 and 28.)

opening was slight and in one case there was none. In two cases the appendix alone showed any gross evidence of disease and without the pre-operative diagnostic studies there would have appeared no reason to do more than an appendectomy. Two cases showed no significant pathological change in the appendix and we do not believe the position that the appendix is the first site of intestinal localization is tenable.

This small series of cases has been satisfactory in regard (1) to the very early determination of the intestinal disease, (2) in the highly satisfactory tolerance of their pulmonary condition to the conditions and sequence of



FIG 25—The same cecum as in Fig 27 as observed in peristalsis and spasm elicited by palpation



FIG 27—Cecum in Case V as observed filled at the six-hour period

TUBERCULOSIS OF THE CÆCUM

laparotomy, (3) in the uniform improvement of their gastro-intestinal function, and (4) in definitely changing the prognosis in one of five cases

SURGICAL NOTE

Surgical interference has been undertaken frequently in cases of tuberculoma or the hyperplastic type of intestinal tuberculosis, which is illustrated by the last case in this series and mentioned in order to contrast it with the ulcerative type in which we are particularly interested. Tuberculoma is a well-



FIG. 29.—Showing pulmonary status at the time of operation in Case VI with no evidence of pathology

recognized condition and has often been described. It is generally agreed that such cases frequently demand surgical treatment, but one gains the impression that this is done not so much for the purpose of eliminating the tuberculous process as it is to determine the question of malignancy in doubtful cases of tumor or as an emergency measure to relieve obstruction. The results of resection of the cæcum in these cases, when it is technically possible, are usually very satisfactory. Not infrequently such patients are relatively free from tuberculosis elsewhere and so far as can be determined, the cæcum is the primary focus of infection. Just as in cases of malignant disease, an early diagnosis is of the greatest importance and an X-ray study of the intestinal tract could hardly fail to discover such a lesion.

Our attention, however, has been chiefly directed to those cases of pulmo-

nary tuberculosis, in which the cæcum had become involved in a secondary ulcerative process, a condition which is usually progressive and terminal. With a patient unable to retain and assimilate food, the struggle against tuberculosis is hopeless. In spite of the very general opinion that surgery has little to offer under these circumstances, we feel that the results which we have thus far obtained, show that operation is definitely indicated in carefully selected cases. A resection of the cæcum, even in patients who are



FIG. 30.—Localized view of the cæcum in Case VI showing the gross filling defects coinciding with a palpable mass and making a difficult differential diagnosis between tuberculoma and malignancy.

not handicapped by pulmonary disease, is a major operative procedure, but in this series we had but one operative mortality and in general the convalescence has been uneventful and satisfactory. In no case was there a continued exacerbation of the chest condition and primary wound healing was always obtained. Obviously, infection is one of the greatest dangers in all operative procedures on the large bowel, but by avoiding un-

necessary trauma and following a very rigid technic, this danger is slight. It is really surprising how well these people stand operation.

It is rarely necessary to employ ether as an anæsthetic, but we would not hesitate to do so if other methods were unavailable. Twilight sleep supplemented by novocaine locally has usually sufficed until the mobilization of the cæcum was undertaken. During this procedure nitrous oxide was given and again during the closure of the peritoneum, although it was not necessary during the actual resection and anastomosis. The patients were usually awake on reaching the ward.

The incision through the right rectus muscle should be ample in order to have easy access to the entire ascending colon and the hepatic flexure and to

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avoid the necessity of undue retraction and trauma of the wound. Occasionally we have been in doubt as to the exact extent of the lesion. In one case there was no visible or palpable evidence of the disease in the cæcum and without the X-ray evidence, resection would not have been justified. It is much better to go well beyond any questionable area than run the risk of leaving behind diseased bowel. The involved area is usually more or less thick-

ened and has an injected, grayish, mottled appearance, and in one case the omentum was adherent over the diseased portion. Thus far our operative cases have never shown involvement beyond the hepatic flexure nor in the terminal ileum. To facilitate the technique, the terminal three or four inches of the ileum are usually included in the resection. After mobilization, the part to be resected is brought out of the abdomen and the peritoneal cavity and wound edges are very carefully protected with gauze packs.



FIG. 31.—Fed test in the same case as Fig. 30 showing disturbed motilities more suggestive of cæcal tuberculosis.

This protection must be scrupulously maintained during the resection and anastomosis. I have made use of a lateral anastomosis between the terminal ileum and the transverse colon and have chosen this method because of its simplicity and safety, and it has given uniformly good post-operative results. At this point in the operation we make a complete change of everything which could have become contaminated during the resection and in this way run little risk of peritoneal or wound infection. Formerly we placed a rubber tissue

drain between the peritoneum and the rectus muscle, but this has been abandoned and the wounds are now closed without drainage

The post-operative treatment is not unlike any other similar case. Fluids are given subcutaneously on the first day and water by mouth is permitted as soon as desired. By the third day patients are usually on a soft diet. It is important, of course, that no rectal treatments be given. It has been interesting to note that the abdominal symptoms have cleared up very rapidly and they are soon able to take a carefully regulated but liberal diet.

We are encouraged by the results thus far obtained. All of the cases in this group have had extensive pulmonary disease and their condition without operation was hopeless. They were relieved of a tremendous amount of discomfort and given a better chance of recovery. It is reasonable to suppose that cases with less pulmonary disease will be helped much more and by means of the X-ray it will be possible to detect such cases and determine the extent and operability of their lesions. In selected cases surgery is not only justified but definitely indicated.

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EXPERIMENTAL RESULTS IN THE USE OF DEAD FASCIA GRAFTS FOR HERNIA REPAIR

By AMOS R. KOONTZ, M.D.

OF BALTIMORE, MD

FROM THE SURGICAL HUNTERIAN LABORATORY OF THE JOHNS HOPKINS MEDICAL SCHOOL

RECENTLY the use of dead material as grafts in the repair of anatomical defects has created widespread interest. This has been due principally to the work of Nageotte and Sencett. These authors have reported the transplantation of pieces of tendon preserved in alcohol or formalin to repair defects in living tendon. Their work has been extensive and their results excellent. A short review of their work, and of events leading up to it, is essential as a preliminary to the recounting of the work reported in this paper.

Before taking up the experimental and clinical work of Nageotte and Sencett, it is desirable to consider a theory of the nature and origin of connective tissue formulated by Nageotte in 1916, and which forms a basis for his subsequent experimental work. For many years there have been in existence two main theories as to the origin of the connective tissues. (1) The exoplasm theory, held principally by Hansen, Mall, Szily, Studnička, and Laguesse. There are several variations of this theory, but, in general, its adherents claim that connective tissue is formed from transformed portions of protoplasm—the exoplasm, which comes from a syncytium of mesenchyme cells. (2) The cellular secretions theory, held principally by Meikel. This theory claims that early syncytium of the mesenchyme cells secretes an amorphous gelatinous non-living ground substance in which the connective-tissue fibres form. In contradistinction to these two theories, Nageotte believes that albuminoid coagula are first formed by the humors of the organism or from the parenchyma cells and that these coagula are no more living than the coral or polyps, that the problem of origin is the same as that of formation of blood plasma. This fundamental substance (substance fondamentale) is not amorphous, but composed of elementary collagen fibrils (fibrille collagène élémentaire). These elementary collagen fibrils give rise to collagen fibres, and connective tissue is formed by the penetration of fibroblasts into the meshes of fibres. The distinctive feature of Nageotte's theory is that



FIG. 1.—Piece of alcohol-preserved dead fascia grafted into the fascia lata of a dog. Removed six months after operation. The black silk sutures indicate the position of the graft.

he insists upon the fundamental non-living character of all the connective-tissue substances

In this connection, the work of Battsell (1915-16) is most interesting. This worker observed the direct transformation of fibrin clot into connective-tissue fibres. Later, tissue cells wandered in, did not digest the fibres, but by

their movements caused a division of the large bundles into smaller ones. These cells were rounded when they first appeared but later assumed the typical elongated spindle shape of fibroblast cells. There was no evidence of a later attempt of these cells to form new fibres. After further work (1917), Battsell showed that the transformation of the fibrin clot was brought about by a fusion and consolidation of the fine elements of which it was composed. In 1921, he showed that the connective tissue in amphibian embryos is formed from a ground substance secreted by the embryonic cells before there is any syncytium of mesenchyme cells. This work tends to lend support to Nageotte's theory.



FIG. 2.—Piece of dead fascia from a cat grafted into the fascia lata of a dog. Four months after operation. The difference in thickness of the graft and surrounding fascia is not due to absorption but to a difference in the original thickness of the structures in the two different species.

Nageotte (1919), described the transformation of dead inclosed protoplasm (dead cartilage cells) into collagenous substance. In 1920, he describes a similar "metamorphism" of the fibrous network.

In 1917, Nageotte published his first experimental work on the use of "dead grafts." Since then numerous papers have come out amplifying and enlarging his results and conclusions. He proceeds on the assumption that if connective-tissue substances are inert coagula formed from living cells, one would not expect grafts of dead tissues to act as foreign bodies and produce phagocytosis, the reaction to "dead" fibres should be the same as that to

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"living" ones. The results of his experiments tend to give approval to his theory of the nature and origin of connective tissues. He transplanted pieces of tendon killed by alcohol or formalin and found that these attached themselves promptly to the connective apparatus of the living tendons which received them. The dead graft takes, and becomes adherent, soon it is impossible to determine its limits because the union between the dead and living tissue has effected itself to perfection.

Microscopic examination likewise shows that the implanted tendon blends with the living tissue until no line of demarcation can be detected. After the dead protoplasm has been carried off by the migratory cells, new fibroblasts from the host flock into the persisting connective-tissue framework of the graft, and establish themselves in the place of the old inhabitants, circulation becomes established by the



FIG. 3 —Dead fascia graft into the fascia lata of a dog. Drawing five months after operation.

growing in of small vessels from the host and in time it is actually impossible to tell that the graft had been dead when it was implanted. Nageotte calls this process the "reviviscence" of the graft, the dead graft has in fact become alive again!

When pieces of dead cartilage are transplanted into the ear of a rabbit the morphology of the graft makes impossible the invasion of fibroblasts from the living tissues. However the graft remains in place unaltered and adherent but not encysted.

The only phagocytosis which one is able to observe is that which is necessary for the removal of dead protoplasm. The persistence of the grafts is

not simply an example of "aseptic tolerance." For in such cases, the foreign body is immediately surrounded by macrophages, and more slowly isolated by fibrous encystment in a word, the so-called aseptic tolerance is accompanied by reactions which show clearly the intolerance of the tissues with regard to the foreign body

Leriche and Policard object to the term "dead graft," claiming that in a graft, the continuity of the personal life of the transplant is preserved Poletti and Bonnefon object to the term "reviviscence" However these objections seem to be only matters of terminology

Besides grafts of dead cartilage and tendon, Nageotte also grafted, with

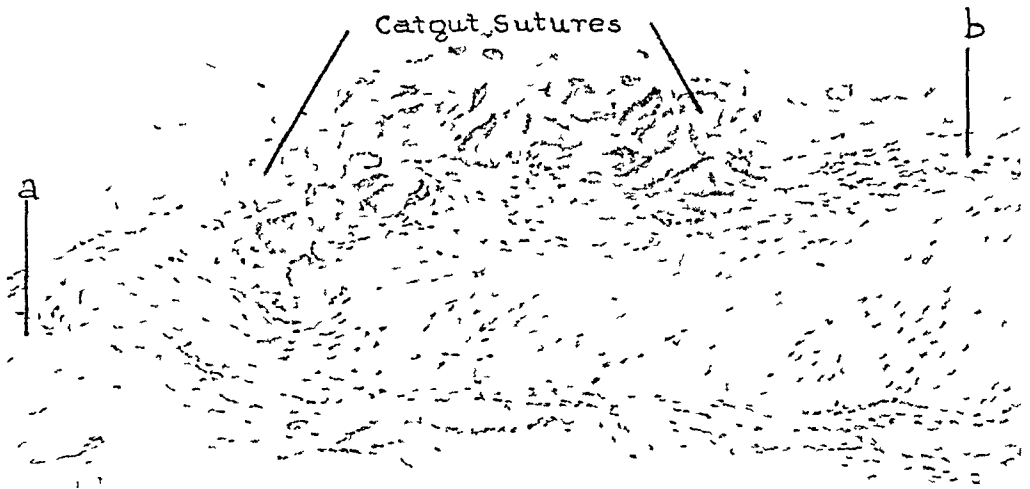


FIG. 4—Microscopic drawing showing union of dead and living fascia Four months after operation
a Living fascia of host b Dead graft

success, segments of dead arteries and nerves Attempts at grafting dead arterial segments were made by Levin and Larkin in 1909, without success They got thrombi, and necrosis and calcification of the implant Carrell, in 1910, got similar results with dead arterial segments—the graft acted as a foreign body and the tissues of the host reacted by building a wall of connective tissue around it Klotz Peimar, and Guthrie in 1923, reported the successful transplantation of devitalized, formaldehyde-fixed vessel segments, but remarked that there was a subsequent tendency to fusiform dilatation of the transplant due to loss of muscle tissue and elastic fibres

Support is given to Nageotte's theories and results by the previous work of several authors, which tends to show that any graft is only relatively "alive" Bonnefon, after several years' researches (1913 *et seq*) on living cornea grafts, opposes the hypothesis of the integral survival of grafts He presents a series of histological facts which demonstrate the partial or total disintegration of the transplant and its regeneration by the graft carrier The dead cells of the graft are replaced by living cells of the host, and the union of the graft to the host is effected by the growing in of fibroblasts from the host Ribbert, Marchand, and Salzer had also previously expressed the view that in corneal grafts the cellular elements of the grafts disappear and

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are replaced by others from the host. In similar vein, Villard, Tavernier, and Perrin, in 1911, expressed the view that vessels preserved a long time in the icebox do not live really, but that one grafts only their elastic skeleton, susceptible at all times of being invaded by cellular elements, which, derived from the graft carrier, furnish it a vitality sufficient to permit it to assure the continuity of the vessel on which it is implanted.

Some observations of Nageotte along the same line are most interesting. He draws a comparison between living and dead grafts and takes, for an example of comparison, a piece of living tendon graft. In such a graft three distinct phenomena occur: (1) the texture of the tissue introduced attaches

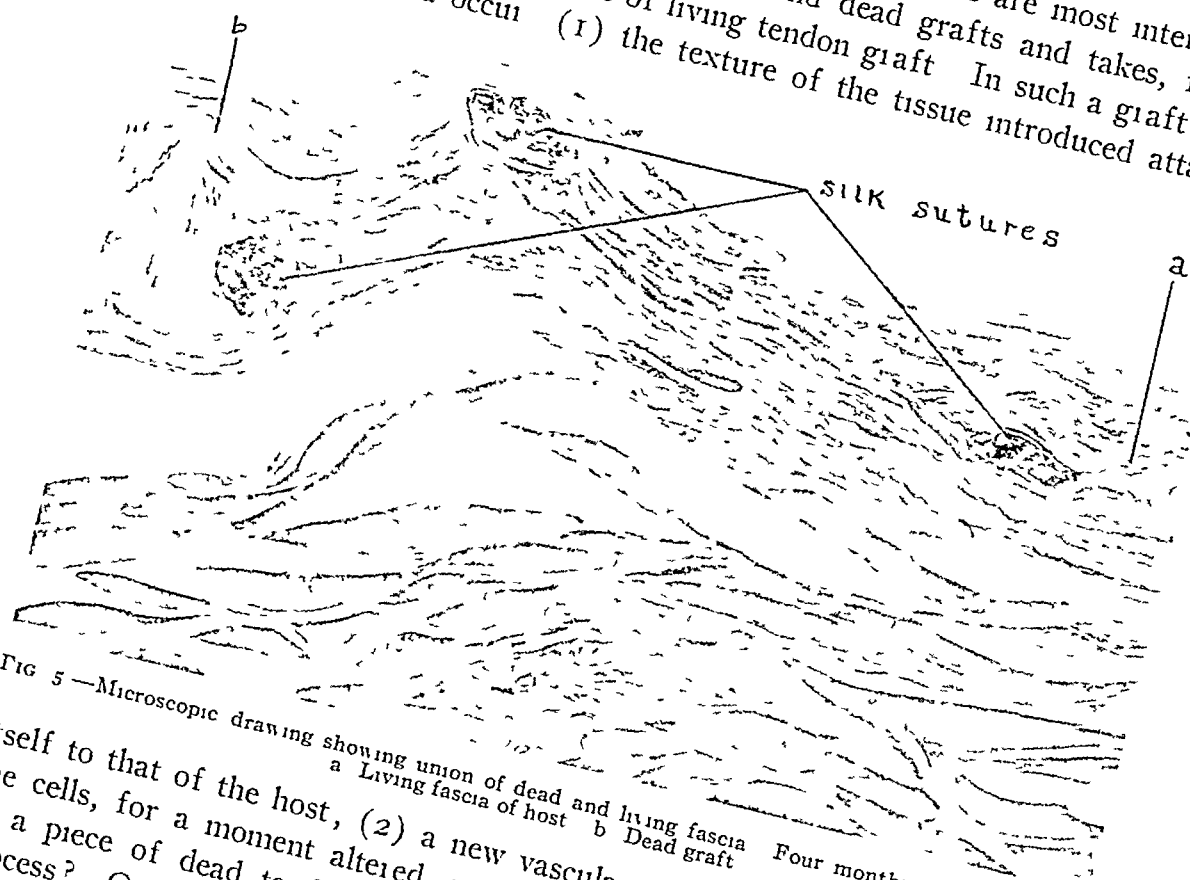


FIG 5 —Microscopic drawing showing union of dead and living fascia Four months after operation
a Living fascia of host b Dead graft

itself to that of the host, (2) a new vascular network is installed, and (3) the cells, for a moment altered, are rehabilitated in their former integrity. If a piece of dead tendon is inserted, what are the modifications of the process? Only the third phenomenon shows a variation: the dead cells are replaced by living cells. The final results are identical. Are there not all possible intermediaries between living and dead grafts? In living grafts kept in the icebox are not a large percentage of the cells dead?

Several workers have achieved excellent surgical results using the methods of Nageotte and Sencert. Nageotte and Sencert themselves, in 1918, reported the bridging of gaps of 3 or 4 cm in tendons on the palmar surface of the wrist with tendons from a dog that had been preserved in alcohol for one month. Good result. Also Sencert, in 1918, reported the use of a dead nerve of a calf to bridge a gap of 2 cm in a median nerve. The continuity of the nerve was established with no scar formation as revealed by a subsequent operation. The report was made too early to be sure of the final outcome, but the result was encouraging, as there was beginning functional restoration. Walther

(1919), grafted 17 cm of a young calf radial nerve of a soldier. Good result

neve preserved in alcohol in the Auvray (1919), bridged a gap of 3 or 4 cm in the tendon of a thumb with dead animal tendon. Good result. Dustin (1919), twice successfully grafted dead nerve of a calf in man. Jalifier (1920), implanted tendons taken from the leg of a calf or dog six to fifty days before. These were used to repair defects in the hand in five cases. Fairly good or very good functional results were reported. A few months later, Jalifier reported the repair of injured nerves with grafts of dead nerves in seventeen cases. Results doubtful. Busacca (1920), grafted dead nerves and tendons. Christophe (1923), successfully grafted an entire patella with its quadriceps and patellar tendons, that had been preserved in 80 per cent alcohol for three days, into the knee of a soldier who had lost his patella from a gunshot wound four months before. The grafted patella was obtained from another soldier who died from a head injury. The functional result was excellent, and a roentgenogram made four years after the operation showed a normal knee. Christophe also transplanted alcohol-fixed dead bone to repair defects in the radius and in the ulna with excellent results. Duirand (1919), and Delorme (1919), observed and commented favorably upon the work of Nageotte and of Sencett. Regoli (1922), Regard (1923), and Weidenreich (1924)

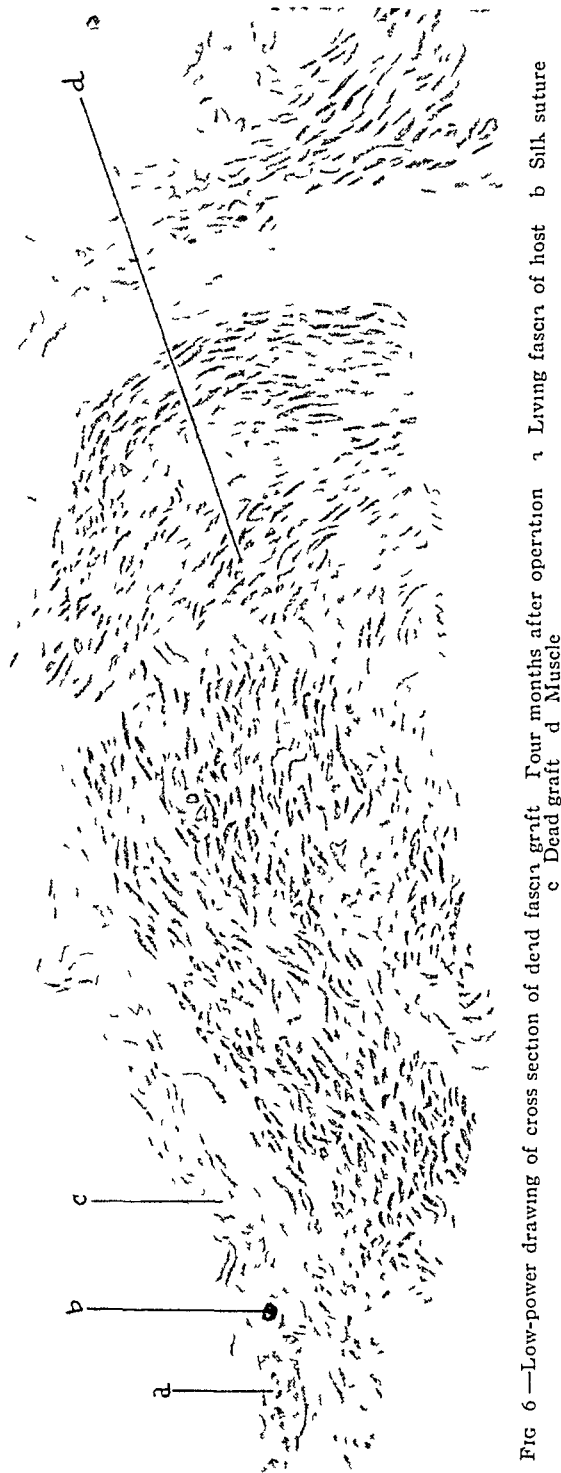


FIG 6—Low-power drawing of cross section of dead fascia graft. Four months after operation. a Living fascia of host b Silk suture c Dead graft d Muscle

have successfully repeated the experimental work of all of these authors. Nageotte and Sencett state that when a gap in a nerve is repaired by a

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graft of dead nerve, the healing which takes place is entirely without scar formation or the formation of neuromata, which often occurs when a severed nerve is sutured. In this connection the recent work of Barthelemy (1920) is most interesting. This author calls attention to the fact that after nerves are injected with alcohol or osmic acid for neuralgia, the pain stops, but returns in about the same length of time as is required for nerve regeneration. He, therefore, did a series of experiments on dogs to determine just what happens when nerves are thus injected with alcohol or osmic acid. He found that after the injections, the nerves first degenerate and then regenerate. The regeneration always occurs entirely without scar formation or the formation

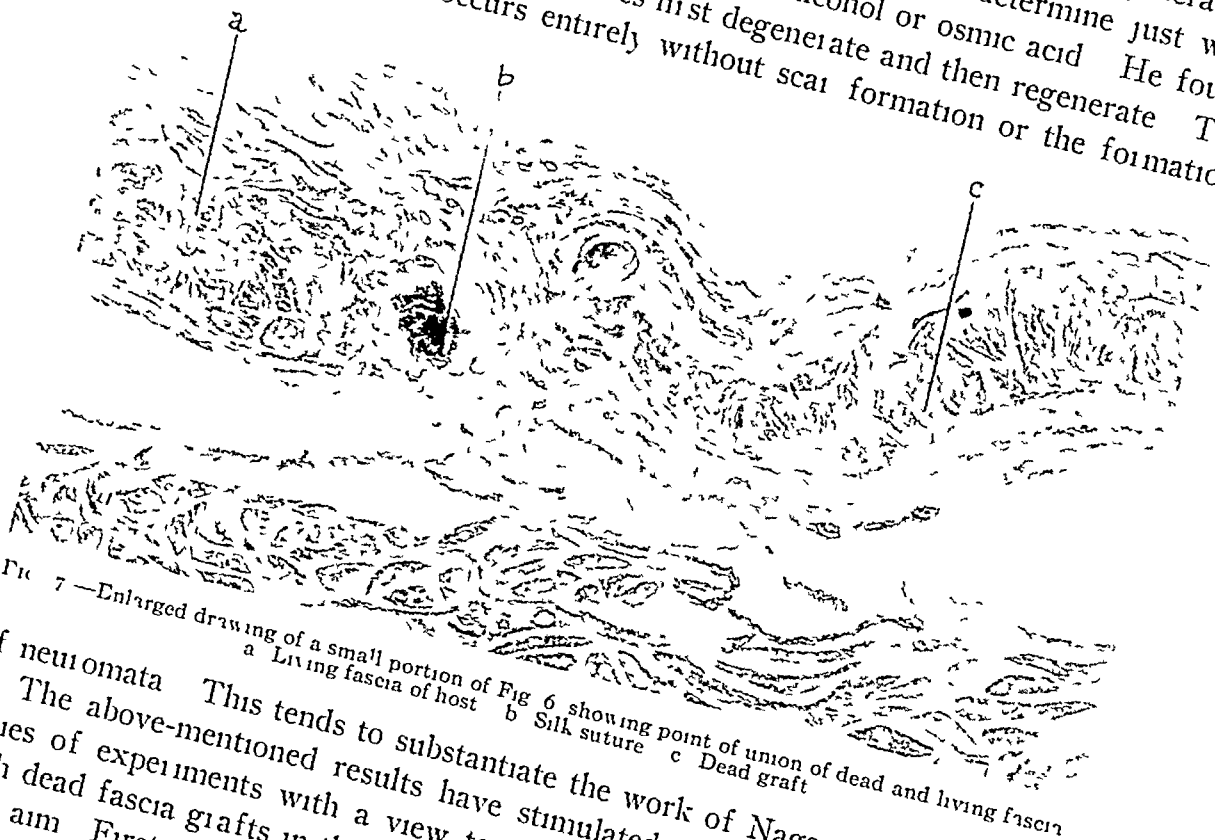


FIG 7—Enlarged drawing of a small portion of Fig 6 showing point of union of dead and living fascia.
a Living fascia of host b Silk suture c Dead graft

This tends to substantiate the work of Nageotte and Sencert of neuromata. The above-mentioned results have stimulated the author to undertake a series of experiments with a view to determining just what could be done with dead fascia grafts in the repair of hernias. We started out with a two-fold aim. First, to determine what becomes of dead grafts of fascia when transplanted among living tissues, and, secondly, if it should be found that the dead grafts survive, to determine whether hernias could be successfully repaired with them.

In order to solve the first part of our problem, namely to determine the fate of dead grafts when transplanted, we performed twenty-one operations on dogs and cats. The materials used in these operations were pieces of fascia that had been preserved in 70 per cent alcohol for varying periods of time (three to seventy-five days). The fascia lata and the sheath of the rectus were the principal sources of the dead grafts. Some of the grafts had been previously taken from the same animal (autografts), and still others were taken from a different species—grafted from cat to dog, or from dog to cat (zoografts). The usual method of procedure was to cut a rectangular

opening in either the sheath of the rectus or the fascia lata and to repair this defect with a piece of dead fascia cut to fit the opening. The thigh proved to be the site of choice for the operation, as the fascia lata is not adherent to the underlying muscle as is the case with the sheath of the rectus. The dead graft was sutured in place by continuous sutures of fine black silk. Catgut was tried but was found not to be as satisfactory as silk for holding the graft in place. The subcutaneous tissue and skin were then sutured over the emplaced graft.

These animals were sacrificed in from two to seven months after operation,

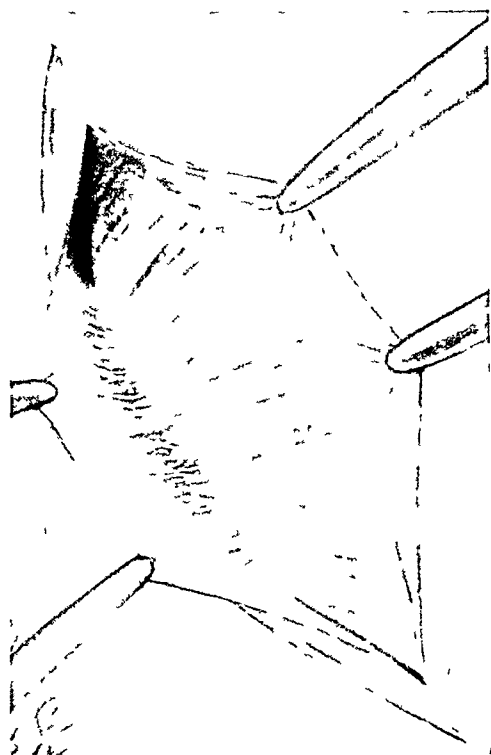


FIG 8—Suture of internal oblique muscle to Poupart's ligament in a dog, by the method of Gallie and Le Mesurier but substituting dead strips of fascia lata for their living sutures. Four months after operation.

and the grafts with the surrounding fascia removed for microscopic section. In a few cases in which the graft was too small to fit the fascial defect, the edge of the graft had pulled away from the edge of the fascia to which it had been sutured. However, in nearly all cases the graft had remained in place and the living fibres had so intermingled with those of the dead tissue that it would not have been possible to tell where one stopped and the other began, except for the row of black silk sutures. Examples of this are shown in Figs 1, 2 and 3. In no cases were there evidences of absorption of the grafts. Microscopically the same intermingling of fibres is seen (Figs 4, 5, 6 and 7). Furthermore living cells can be seen to have wandered in among the dead fibres, so that the former dead graft is now, in effect, living tissue.

From the foregoing, and the work of the other authors quoted above, it appears that dead fascia used as grafts can be counted upon to remain in place and to do the same work as the living grafts ordinarily used for the same purposes. Why then can not dead strips of fascia lata be used in the new operations of Gallie and Le Mesurier for hernia instead of their "living sutures"? Would it not simplify their procedure a good deal to be able to take their suture material out of a jar in the operating room rather than to have to perform an additional operation in order to get this material? In order to try out this simpler procedure, we sutured the internal oblique muscle to Poupart's ligament in two dogs, using strips of dead fascia lata as suture material, and employing the technic advocated by Gallie and Le Mesurier. As pointed out by the author in a previous communication, the internal oblique muscle

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forms a greater angle with Poupart's ligament in the dog than in man. Therefore, it requires more tension on the tissue to bring these two structures into apposition by suture in the dog than in man. In spite of this, and the use of strips of *dead* fascia as suture material, we got the finest sort of dense fibrous union of the muscle to the ligament in both of our operations (see Fig 8). In fact the union was much finer and accompanied by much denser adhesions than that previously reported when silk or catgut was used as suture material.

We next undertook to produce large ventral hernias in dogs, and then to repair them by the use of large grafts of dead fascia. A ventral hernia is hard to produce in a dog, as any defect made in the abdominal wall tends to repair itself by an excessive growth of fibrous tissue. We early noted that when the external sheath of the rectus was removed for subsequent use as a dead graft, that subsequent operation or autopsy showed the defect to be repaired by a dense overgrowth of fibrous tissue much stronger



FIG 9 —Repair of large ventral hernia in a dog with a piece of alcohol-preserved fascia lata of an ox. Five months after operation.

than the original rectus sheath. We also learned by repeated attempts at hernia production that a wide excision of abdominal wall was necessary, and so came to employ the following procedure. Three or four inches of the rectus muscle on both sides were excised, including both the external and internal rectus sheaths. The peritoneum was opened with a large crucial incision, and left open. The subcutaneous tissue and skin were then sutured over this opening. The result was a large bulging ventral hernia.

In a few weeks this hernia was repaired with a large piece of dead fascia. Various materials were tried, including the submucous coat of the pig's bladder, the pericardial sac of the ox and the fascia lata of the ox. The last named material proved most satisfactory, as it is tougher and has practically no give to it. The operation was conducted in this manner. The skin was opened, and any excess fibrous tissue that had grown across the defect in the abdominal wall was removed leaving only a very thin layer of subcutaneous tissue between skin and peritoneum. The sheath of the rectus, bordering the defect above and below, and the external oblique, bordering it on the sides, were then exposed. The graft of dead fascia was then placed so as to overlap the edges of the defect and sutured in place. Above and below it was sutured to the sheath of the rectus, and on the sides to the fascia of the external oblique muscle and the external oblique muscle itself. Fine black silk doubled was used as the suture material. The buttonhole stitch was tried, but the ordinary continuous suture proved better. The subcutaneous tissue and skin were then sutured over the graft. The dogs thus operated upon were sacrificed in from four to six months after operation. Figure 9 shows a typical result. The hernia was completely cured, and the dead and living fascia would have been indistinguishable, except for the line of suture.

In the foregoing experiments, fascia from several different species were transplanted into other species indiscriminately, and with no ill effect. Heteroplastic grafts took just as well as homoplastic ones. Other workers with dead grafts have had the same experience. It is well known that this is not true of living grafts. The possible explanation is that the preservation of the graft in alcohol or formalin eliminates the antagonistic action of foreign sera. Occasionally, however, certain dead heterogenous grafts appear to be toxic. Nageotte (1920) says that the tendon of the tail of the white rat or of the sewer rat used for suture of pieces of nerve in the dog or transplanted into the eye of the rabbit, provokes a chronic inflammation which produces its destruction slowly without suppuration.

CONCLUSIONS

- 1 Grafts of dead fascia, preserved in alcohol, when transplanted among living connective tissues, remain intact and unite with the tissue of the host. After a period of a few months it is impossible to distinguish the living from the "dead."

- 2 The living and "dead" are likewise indistinguishable microscopically.

- 3 The suturing together of the internal oblique muscle and Poupart's ligament with strips of dead fascia in the dog results in the firmest type of fibrous union.

- 4 Large, experimentally produced, ventral hernias in the dog can be successfully repaired by the use of large grafts of dead fascia.

- 5 Dead fascia grafts may be homogenous or heterogenous.

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At the end of the operation his systolic blood-pressure was 83, and his pulse was barely perceptible. His condition seemed desperate and proctoclysis and bandaging of the three extremities were resorted to. The patient rallied fairly rapidly but had a very sharp reaction reaching a temperature of 103-4/10 and a pulse of 136.

On the eighth day he gave the signs and symptoms of pulmonary embolism, coughed up bloody sputum, had pain and a temperature reaction. In the next few days he had eight or ten more pulmonary emboli. From the thirty-fifth post-operative day his temperature was normal, but he had a productive cough with blood-stained sputum. His skin reaction to old tuberculin was positive, but no tubercle bacilli could ever be found on repeated examinations.

CASE III—*Ruptured Jejunum*—A man, forty-one years of age, entered New York Hospital December 17, 1925, in the service of Dr. Charles L. Gibson. Three hours before his admission he had fallen ten feet landing on a beam on his abdomen. He was not unconscious, did not vomit, but complained of severe pain in the chest and abdomen, and of extreme tenderness. There was no bleeding from the mouth nor from the rectum. He immediately passed urine spontaneously and it contained no blood.

Although he gave a history of a perforated gastric ulcer four years before this accident and he had also had enteric fever and pneumonia, he was a very robust man, apparently in perfect health. On admission to the hospital his pulse was 80 and dropped to 72. His respiration was normal and remained so throughout. His temperature was normal. There were a few abrasions on the pubis and thighs and marked tenderness in the left and right lower chest in front, and very marked rigidity of the entire abdomen with no special spot of tenderness. The patient appeared in excellent general condition with good strong pulse, good color and smiled when talked to, although he said he was in extreme pain. His blood-pressure on admission was 135 over 90. One hour later it was 120 over 70, and one-half hour later still 120 over 70. The leucocyte count was 12,000 with 76 per cent polymorphonuclears, and in an hour it had risen to 22,000 with 88 per cent polymorphonuclears. His urine was normal except for a few leucocytes and doubtful red cells. An X-ray picture of the abdomen revealed no free gas in the peritoneal cavity.

At the end of one and a half hours of observation, his pulse had risen to 80, there was still marked rigidity and complaint of great pain in the abdomen without localization, an increased blood count, and a slight drop in blood-pressure. Although his excellent color and quality of pulse, no vomiting, no passage of blood, no free gas in the peritoneal cavity, no localized spot of tenderness, would have warranted a waiting policy the safer course seemed to be an exploration, with the tentative diagnosis of rupture of a viscus. Under ether narcosis the old scar for gastric perforation was reopened. A few omental adhesions were found, the abdomen proved to be filled with recent and old blood and a very moderate amount of fluid feces. There was absolutely no gas as determined by the Gibson Water Test on entering the peritoneal cavity. The first loop of bowel presented was the upper ileum or lower jejunum. It was torn nearly completely across transversely. It was no longer bleeding. There was very slight fecal leakage. The entire bowel for a considerable distance had nearly completely collapsed. This tear was at once repaired with fine chromic catgut. A search was then carried out from the ileocecal valve to the end of the duodenum. A second tear in the bowel exactly similar to the first was found in the jejunum two or three feet above the first lesion. This was repaired with chromic catgut. The lacteals were

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SKIN PLASTICS IN THE TREATMENT OF TRAUMATIC LESIONS OF THE HAND AND FOREARM

BY HENRY H M LYLE, M D
OF NEW YORK, N Y

THE criterion of success in treating disabilities of the hand is the restoration of function. Prompt healing is an essential requirement in obtaining



FIG 1—Illustrating the primary closure of wound by pedunculated flap and extensor tenoplasty. Epithelioma developing in the scar of an old burn. Patient refused amputation so an excision of the growth and axillary glands was performed.

early functional use, and it is our belief that much time is saved by the employment of suitable skin plastics.

Due to the extent or nature of the traumatic lesion, it may be unwise or impossible to immediately carry

out an ideal closure. Under such circumstances we can reduce the probable duration, extent and severity of the disability by tissue transplantation. The desired closure can be obtained by a primary, or a secondary skin

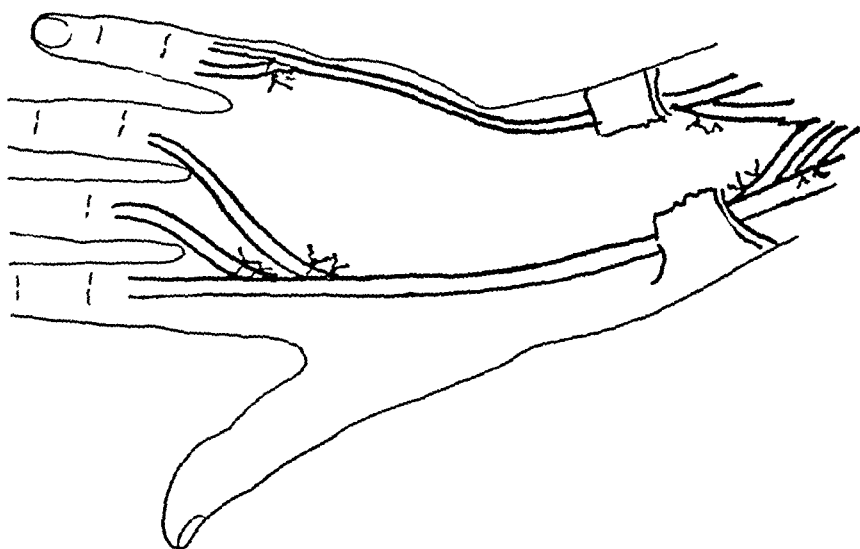


FIG 2—Illustrating the primary closure of wound by pedunculated flap and extensor tenoplasty. Diagram of extensor tenoplasty. All the soft structures were excised with the exception of the tendons of index finger and the inner slip of the little finger. The proximal and distal ends of the excised tendons were sutured as shown.

plastic. The object of the former is an immediate healing of the wound, of the latter a hastening of the healing by providing an epidermal covering.

No two problems are exactly alike and we must be prepared to meet an

* Read before the New York Surgical Society, December 9, 1925

endless variety of conditions Skin plastics may be employed singly, in combination, or in series and as primary or secondary closures We will not go into the details of the numerous plastic operations but direct attention



Fig. 3—Illustrating the primary closure of wound by pedunculated flap and extensor tenoplasty After the tenoplasty the excised area was immediately closed with a pedunculated flap from the abdomen Note that it extends from the knuckles to two and one-half inches above the wrist The patient has obtained a useful hand

to the value of the early employment of certain procedures Under the term skin plastic we include all tissue transferring procedures that are used in closing defects, epidermic grafts, full thickness grafts, sliding flaps, peduncu-

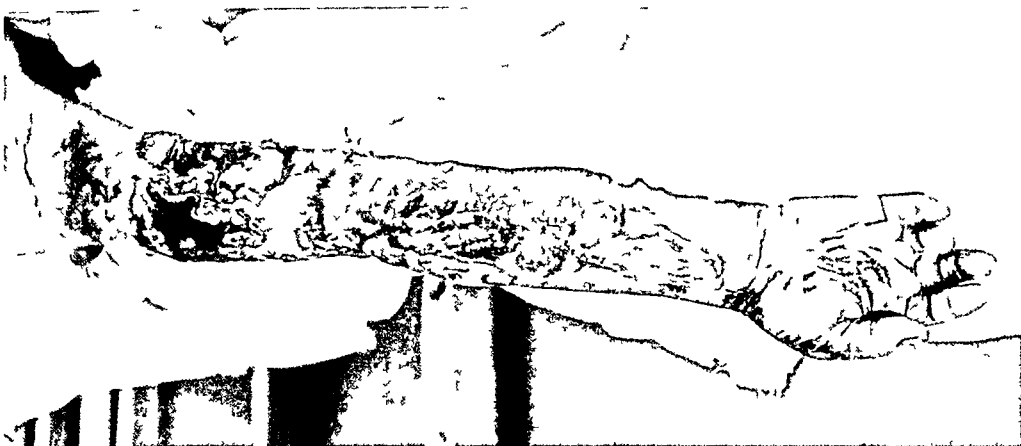


Fig. 4—Illustrating secondary closure by Olivier-Thiersch graft's Hemolytic streptococcus "gangrene" with extensive destruction of skin

lated flaps from the immediate neighborhood, pedunculated flaps from a distance, and doubled-leaved flaps

Skin Plastic Measures Employed with the Object of Obtaining a Primary Permanent Closure—The ideal method is to perform a careful debridement and immediately cover the raw surface with a suitable flap To do this we must have ideal conditions, the control of the patient from the time of the

accident, a good blood supply, and a probable aseptic field. This method is employed with advantage in partial and atypical traumatic amputations.

In moderate skin destruction without tendon exposure a full thickness graft can be used as a primary procedure. This type of graft is used with advantage in the palm and the fingers. The chance of success on a fresh



FIG. 5 —Illustrating secondary closure by Ollier-Thiersch grafts. Shows condition of arm 43 days later. The result after debridement, Carrel treatment and Ollier-Thiersch skin grafts. Contrast with Fig. 6.

surface is about 85 per cent. It is not to be used on granulating surfaces, a fresh clean bed is required.

In small defects where a moderate amount of contraction is of no importance an Ollier-Thiersch graft can be employed, on the other hand, if the



FIG. 6 —Illustrating the result of expectant treatment for burn. After eighteen months she is still unhealed, has a useless hand fixed in extension and a dorsal dislocation of the thumb. Much pain, disability and loss of time could have been saved by a prompt secondary skin graft.

skin defect is large and the tendons exposed, a pedunculated flap from a distance will be required. If the conditions are such that the latter cannot be obtained and the local tissues do not furnish enough material for the closure of the defect, an immediate partial permanent closure can be carried out. The exposed tendons are covered with a sliding flap or with a local pedunculated

flap, and the flap bed closed by an Ollier-Thiersch graft, the final revision of the wound being deferred to a later date

Pedunculated flaps from a distance are indicated as a primary procedure



FIG. 7—Illustrating the use of skin plastics in series. Eight days before admission patient's hand was caught in hot mangle. All structures were torn off exposing the metacarpals and opening the metacarpophalangeal joint of the ring finger. Note absence of tendons the exposed bone and the open fifth metacarpophalangeal joint with dislocation of finger. The wound is infected

in the large skin defects with exposure of tendons where the surgeon has created the conditions. For example in defects left after the excision of tumors, contractures and X-ray burns (Figs 1, 2, 3)

Secondary Closure by Ollier-Thiersch Grafts—(Figs 4, 5, 6) This

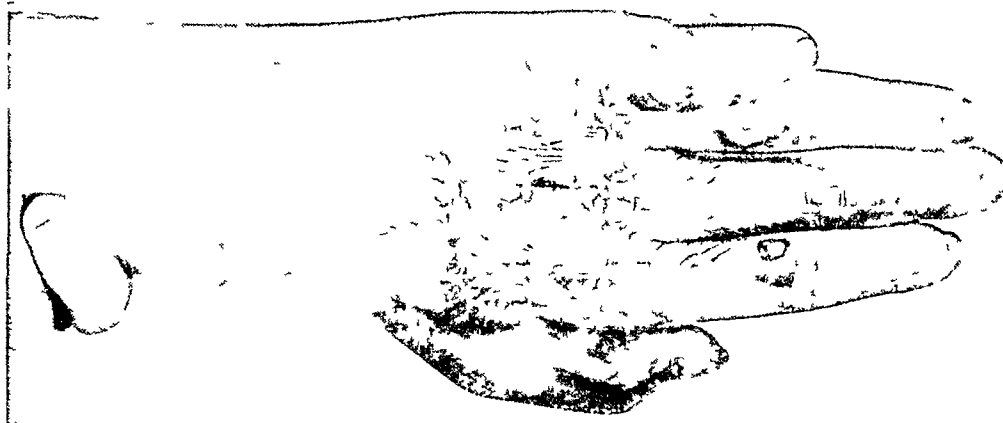


FIG. 8—Illustrating the use of skin plastics in series. Wound treated by the Carrel method and four days later closed with pedicle flap from abdomen. Failure due to erysipeloid infection. Twenty-four days later wound successfully closed with an Ollier-Thiersch graft. Note the small dark area of bone necrosis over the third metacarpal, the removal of this necrotic scale stirred up a second sharp erysipeloid inflammation and all operative work was postponed

method finds its greatest usefulness in extensive destruction of skin, in large granulating areas, in burns, and ulcerations. These lesions are extremely common and as a class cause much suffering and disability. Unfortunately

PLASTICS IN LESIONS OF HAND AND FOREARM

only a small proportion of these sufferers receive the benefit of an early plastic covering. The object of the treatment is to sterilize the wound and provide

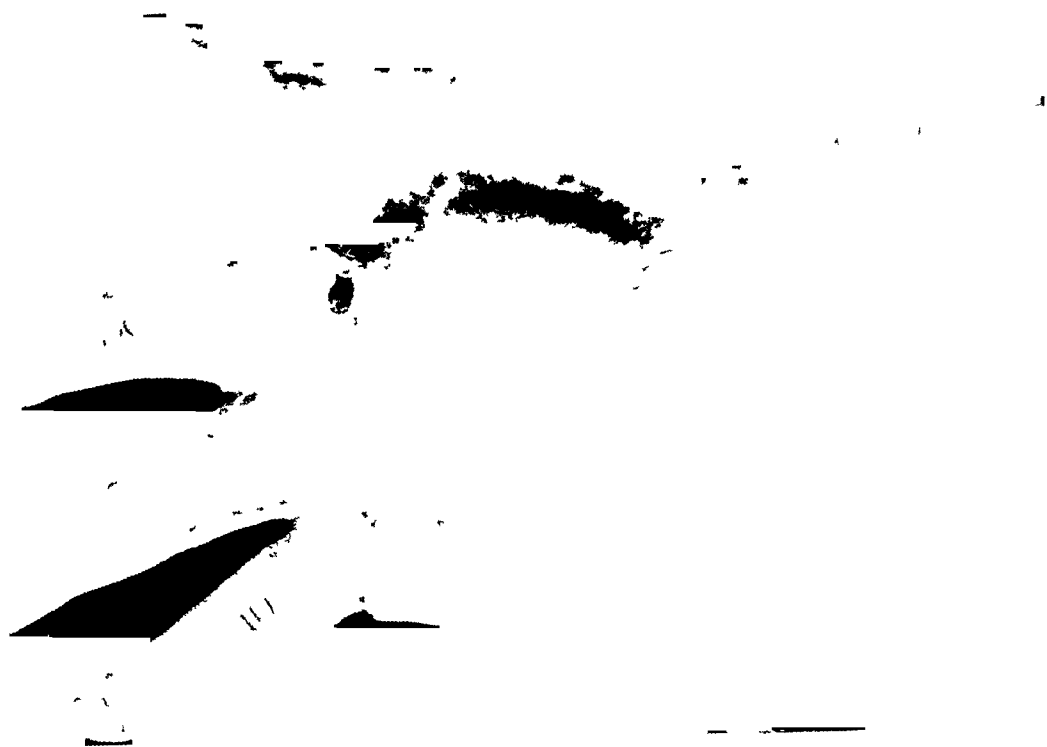


FIG 9 —Illustrating the use of skin plastics in series. Three months later the Ollier-Thiersch graft was excised and replaced by a pedicle flap from the abdomen.

an epidermal covering. Thanks to Cannel we can almost guarantee the take of Ollier-Thiersch grafts. Prompt sterilization combined with epithelization of a granulating area prevents the excessive production of scar tissue, improves the nutrition of the part, hastens healing and provides the best defense against infection, and by allowing early functional use it minimizes the possibilities of future contractions. Compare the results in Figs 4 and 5 with 6.

The Use of Skin Plastics in Series (Figs 7,

8, 9, 10, 11) —The object of this method is to obtain the physiological and anatomical advantages of an early temporary closure, so that further recon-

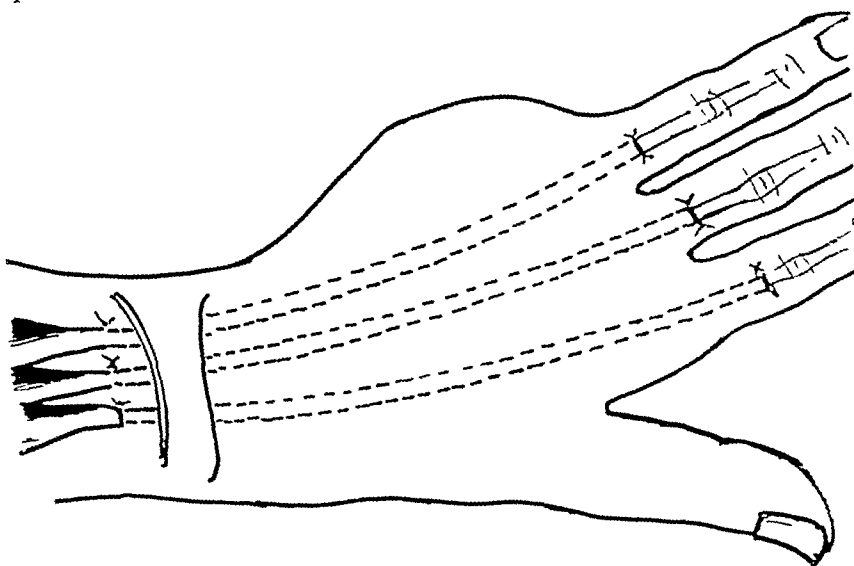


FIG 10 —Illustrating the use of skin plastics in series. The proper bed for a tendon transplantation having been formed a tree transplantation of tendons from the long extensor of the foot was made into the hand. A transverse incision was made in the base of each finger and in the forearm above the flap and the latter then tunnelled. The grafted tendons were inserted through the tunnels and stitched to the stumps of the extensors in the fingers and in the arm. The ankylosed little finger being useless was amputated.

structive surgery can be carried out at a more opportune time. This method provides surgical insurance for future work. In the face of a recent infection it is unwise to attempt extensive reconstructive work, therefore, temporary Ollier-Thiersch grafts are applied and later when the nutrition has improved and the danger of infection has passed the temporary graft is excised and a pedunculated flap or other suitable plastic covering substituted. When the nutrition of the new graft is assured, we are in a safe position to carry out

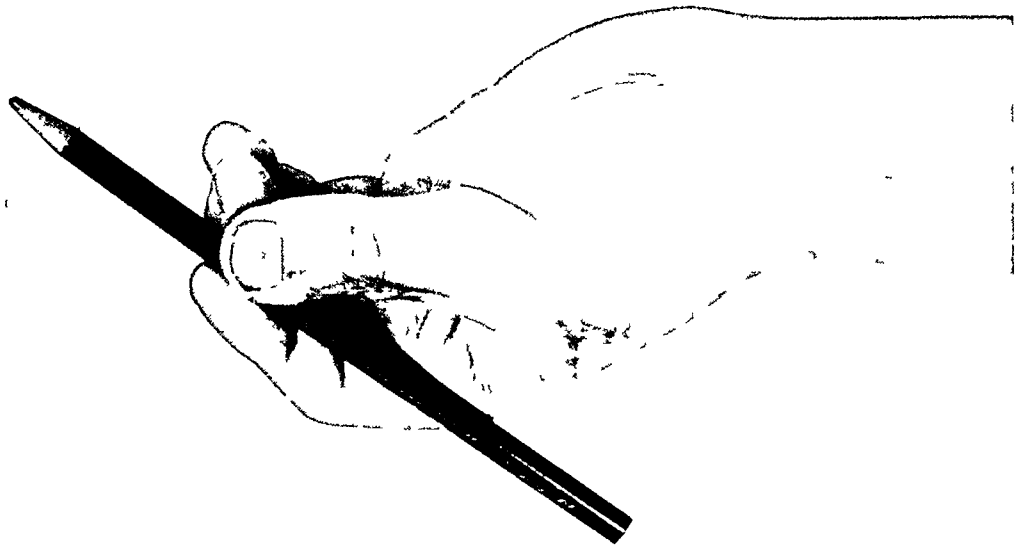


FIG. 11—Illustrating the use of skin plastics in series. Shows the grasp. Fig. 9 shows extension and separation of fingers. The patient has a strong useful hand.

any desired reconstructive plan, *e g*, the formation of new digits, free tendon grafting, arthroplasties, bone grafts, etc

CONCLUSIONS

- 1 The prompt sterilization and early application of Ollier-Thiersch grafts to granulating areas, burns, ulcers, etc, will save the patient much time, suffering and disability
- 2 The possibilities of reconstructive surgery in unfavorable cases can be greatly extended by the use of plastics in series
- 3 These simple procedures should be employed much more frequently than they have been in the past

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY

Stated Meeting Held December 9, 1925

The President, DR WALTON MARSH in the Chair
COMPLETE CONGENITAL OBSTRUCTION OF THE DUODENUM,
DUODENO-JEJUNOSTOMY AT NINE DAYS

DR RICHARD W BOLLING presented a female baby born on October 13 on the service of Doctor Doiman at the Woman's Hospital. Birth-weight was six pounds and nine ounces and she appeared to be a normal infant. As soon as nursing was begun, vomiting was noted and the vomiting persisted, though not after each feeding. Typical meconium stools appeared and the character of the stools did not change. Dr Harold Mixsell made a diagnosis of probable congenital anomaly and a roentgenogram made on the eighth day showed a complete obstruction of duodenum, with great dilatation of proximal segment. Dr Downes saw baby in consultation, he advised operation and referred infant to Babies' Hospital, where Dr Bolling operated on ninth day. At the time of operation the baby weighed five pounds. The stomach was greatly dilated, the pylorus appeared normal and the duodenum was dilated to about two-thirds the size of the stomach. The colon was closely

applied to the mesial surface of the dilated duodenum. No attempt was made to ascertain the exact cause of obstruction. An anastomosis between the dilated duodenum and the jejunum, about ten centimetres below the flexure, anterior to the colon, was effected. Jejunum was collapsed, its diameter somewhat less than that of lead pencil. Convalescence was stormy for several days and complicated by infection of the wound. The stump of the umbilical cord was present at the time of operation and did not separate until the fourteenth day. Milk stools were

FIG. 1.—Complete congenital obstruction of the duodenum. Six hours after opaque meal.

FIG. 2.—Complete congenital obstruction of the duodenum. Six weeks after duodeno-jejunostomy. A few minutes after opaque meal.

markedly engorged but there seemed almost no fluid residue in the bowel and no gas. Very careful examination of the entire abdomen revealed no evidence of further injury. The pelvis was filled with fluid blood and a little fecal material. This was found also scattered throughout the abdomen and was removed with an aspirator. The stomach was apparently intact, showing no evidence whatever of the old perforation, except a few fine adhesions around the duodenum and the spleen. The abdomen was closed in layers without drainage. The patient left the operating table in excellent condition and with a pulse of 92.

The wound healed by primary union, although the patient developed a mild post-operative pneumonia.

GASTRO-MESENTERIC ILEUS

DR CHARLES L. GIBSON presented a man, age twenty-seven years, who was admitted to the New York Hospital, June 17, 1925. He gave a history of epigastric pain and distress over a period of two years, and vomiting and other signs of pyloric obstruction for a period of two months. Fluoroscopic examination showed a dilated stomach and duodenum with twenty-four hour retention, and obstruction apparently at the apex of the duodenum. At operation a band was found which constituted third portion of the duodenum, causing a marked dilatation. Since the band contained the superior mesenteric artery, it was impossible to divide it, so a posterior no-loop gastro-enterostomy was done.

Except for some vomiting on the first post-operative day, convalescence was uneventful. He was discharged on the thirteenth post-operative day, in good condition, the wound healed. Three months later, he had been eating everything and had gained about twenty pounds.

Six months later, Excellent condition. Has held his twenty-pound gain in weight.

CASE II—DOCTOR GIBSON presented also a man, age twenty years, who was admitted November 15, 1924, with a history suggestive of appendicitis. Appendectomy was performed, but showed little if any pathological condition. One month later he was readmitted on account of intense and continuous pain in lower abdomen, increasing in severity. Vomits also quite frequently, usually a half to an hour after meals.

A fluoroscopic examination resulted in a diagnosis of post-pyloric ulcer. At operation, a large distended stomach and duodenum, as far as third portion, found. No apparent ulcer could be made out. The duodenum was sharply obstructed at the site of the superior mesenteric artery. A posterior gastro-enterostomy was done.

He made a good convalescence. On discharge, condition greatly improved. Pain and epigastric distress entirely relieved.

Three months later, Stomach in fine condition. Can now eat all kinds of food.

A year later, Excellent condition. Eats all kinds of food with no discomfort.

DOCTOR GIBSON remarked that these patients were operated on and are reported with a full appreciation that the operation of gastro-enterostomy in such conditions is considered by many, perhaps most, authorities as not the most suitable operation.

noted on the second post-operative day and there has been no vomiting since that time. Gain in weight has been slow but progressive. The wound is soundly healed (Fig 2).



Duodeno-jejunostomy seems to be the operation of choice in this condition and the operation anterior to the colon was chosen, as it seemed simpler under the circumstances. A similar procedure was carried out by Doctor Ernst of Copenhagen in 1914.

To illustrate the anatomical condition, Doctor Bolling presented a specimen removed twenty-three days after operation in a similar case (Fig 3). In this instance a posterior gastro-enterostomy was done. The obstruction was due to a diaphragm the site of which

FIG 3—Complete congenital obstruction of the duodenum. Specimen removed at autopsy twenty three days after gastro-enterostomy.

is indicated in the drawing (Fig 4). Infection of the wound was the only serious post-operative complication and was the direct cause of death in the fatal case. In each instance the infection was to be attributed to an unhealed and infected umbilicus.

DR EDWARD W. PETERSON said that he had taken care of an infant only a few days old with a congenital obstruction of the duodenum similar to Doctor Bolling's case. The diaphragm in the duodenum, while not complete, was sufficient to cause obstruction of the bowel. An operation on the plan of the Horsley pyloroplasty relieved the obstruction satisfactorily. Unfortunately, the child

was in such poor condition at the time of operation that death followed a few hours later.

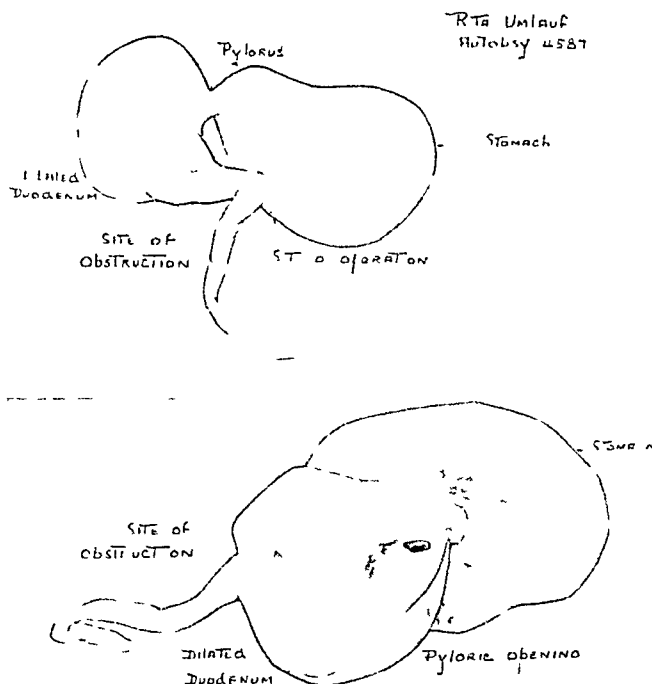


FIG 4—Complete congenital obstruction of the duodenum. Drawing indicating site of diaphragm causing obstruction.

CHRONIC IRREDUCIBLE INTUSSUSCEPTION

CHRONIC IRREDUCIBLE INTUSSUSCEPTION IN TWELVE MONTHS' INFANT, RESECTION

DR RICHARD W BOLLING presented a female baby who was admitted to the Babies' Hospital, June 17 1925 having been referred to the hospital by Doctor McLean At the time of admission the baby was ten days less than twelve months old Two weeks before admission the child became irritable, vomited, and passed dark blood and mucus per rectum, and the abdomen became distended The child remained irritable, but the vomiting ceased and the distention gradually became less Mucus was passed but no blood For several days before admission stools were normal There had been considerable loss in weight

On examination the child did not appear acutely ill, was apathetic and somewhat dehydrated There was no suggestion of distention In the right upper abdomen and extending across the midline was an oblong rounded mass

No intermittent contractions were made out A diagnosis of chronic intussusception was made and this was confirmed by means of a bismuth enema (Fig 5)

Operation was carried out on the following day and an ileocaecal intussus-



FIG 5—Chronic irreducible intussusception Opaque clyster



FIG 6—Chronic irreducible intussusception Specimen removed

ception extending into the splenic flexure was found The small intestine was dilated and its walls greatly thickened Reduction of the intussusception was easily carried out until the upper portion of the ascending colon was reached, when further reduction was impossible A resection of the distal

ileum, the cæcum and the ascending colon, followed by axial anastomosis of the ileum and transverse colon, was carried out (Fig 6) Convalescence was fairly smooth and the wound healed without incident

In an experience of about one hundred cases of intussusception in infancy, he had seen only two instances of chronic invagination

OVARIAN CYST FREE IN PERITONEAL CAVITY OF THREE MONTHS' OLD INFANT

DR RICHARD W BOLLING presented a female baby, admitted to the Babies' Hospital, April 15, 1925 The history was that of vomiting almost since birth, with loss of weight for six weeks The infant appeared in wretched condition, emaciated and dehydrated In the right lower quadrant there was a rounded elastic mass somewhat larger than a golf ball This was freely movable and could be displaced into each quadrant of the abdomen



FIG 7 —Ovarian cyst free in peritoneal cavity of three months infant

At operation the mass was easily delivered into the wound and then rolled off to one side of the table, having no attachment whatever (Fig 7) The uterus appeared normal and a normal tube and ovary were on the left side The tube and ovary on the right side were absent there being only a smooth short stump of the tube remaining Spontaneous separation as a result of torsion of an ovarian cyst seems the prob-

able explanation Microscopic examination confirmed the diagnosis of multilocular ovarian cyst

The immediate post-operative recovery was smooth, but the child subsequently developed a severe funiculosis which greatly prolonged its stay in the hospital

DR ROBERT T MORRIS reported a similar case in an adult in whom the cyst was discovered, by pathological examination, to be parovarian in origin He asked whether a pathological examination had verified the ovarian orifice of this cyst

DOCTOR BOLLING, in closing the discussion, said that the pathological examination in this case had proven the cyst to be ovarian

CARCINOMA OF THE STOMACH RESECTION-IMPLANTATION OF DUODENUM INTO PANCREAS

DR CHARLES GORDON HEYD presented a man, forty-three years of age, who entered the Post-graduate Hospital, September 29, 1925, complaining of cramp-like sensations, localized in the epigastrium, appearing two to three

CARCINOMA OF THE STOMACH

hours after eating. This pain has been relieved occasionally, but not uniformly, by a glass of hot water. There has been no nausea or vomiting. The patient has never had any jaundice with the present complaint but has observed tarry stools on a few occasions. His best weight has been 160 pounds. His present weight is 135 pounds. Coincident with the loss of weight patient noticed a feeling of weakness, with increasing dyspnoea on exertion.

On physical examination of the patient nothing noteworthy was determined. On X-ray examination an irregularity was seen on the mesial surface of stomach, at the distal portion of the pylorus, with a narrow canalization through this area.

At operation, October 7, 1925, an infiltrating carcinoma was found, involving the distal third of stomach. Protruding through a patulous pylorus was an annular carcinomatous ulcer with involvement of the lymph-glands along the lesser curvature and between duodenum and pancreas. The lymph-glands along the lesser curvature seemed hyperplastic and inflammatory, whereas the glands beneath the pylorus and duodenum were undoubtedly metastatic carcinoma. The liver was not involved. A subtotal resection of the stomach, pylorus and first portion of the duodenum was carried out, after which a Billroth No. 2 operation was performed. After the excision of the duodenum there was insufficient duodenal tissue to make a complete inversion. The lumen was obliterated by oversewing with No. 2 chromic catgut and no attempt was made to invert the stump. The duodenum was elevated, turned over and to the right and sutured firmly in place on the anterior surface of the pancreas. In other words, the mucosa of the duodenal stump was in direct contact with the peritoneum of the pancreas. This made a very neat and hermetic closure and the subsequent post-operative course demonstrated the efficiency of the duodenal blocking.

The tissue removed was a piece of stomach, 120 x 75 mm. The diameter of the ulcerated area was 75 x 80 mm. The periphery of the ulcer presented a projecting margin rising about 15 mm. above the general surface and from 8 to 12 mm. in width. The ulcerated surface was finely granular and red without any evidence of mucous membrane. The wall of the stomach showed a marked thickening of the submucous layer which was well defined from the muscular coat. In the large omentum there were several lymph-nodes which were firm.

Section of the floor of the ulcer showed dense fibrous tissue richly infiltrated by irregularly branching gland tubules. These were lined by highly irregular columnar epithelium. They extended to the muscle coat. Sections of the lymph-nodes in the omentum showed extensive replacement of the structure by neoplasm in some of these. Another lymph-node showed only a very small collection of epithelial cells. Still another lymph-node showed only inflammatory reaction. Pathological diagnosis: Large ulcerated adenocarcinoma of the pyloric end of the stomach with extension to the lymph-nodes in the omentum.

The patient had a rather strenuous post-operative course but was afebrile at the end of the fifth day. On the ninth day he developed a temperature of 103.5° which fell to 101° next morning, and for a week he continued with a temperature of 101°. On the sixteenth day post-operatively he developed a temperature of 103° and at the same time an area of localized dullness below the right scapula. On paracentesis about fifteen cc. of dark brown, foul-smelling fluid was obtained, which on culture proved to be streptococci and

a Gram-positive cocci forming green colonies on plates, probably pneumococci. X-ray examination on this date showed partial lung retraction with a fluid level well above the middle of the right pulmonic field, evidently a localized encapsulated partial hydropneumothorax. October 27, on the seventeenth day post-operative, Doctor Moolten did a rib resection and excised a portion of the seventh rib and drained a localized empyema, evidently secondary to a subpleural abscess probably of embolic origin. In the meantime, the gastric wound healed thoroughly and the patient proceeded to an uneventful convalescence and was discharged from the hospital November 10, thirty-three days after his original gastric operation.

The interesting feature of this case was the necessity of resecting the tumor from the anterior surface of the pancreas, together with a loss of so much duodenal tube as to make the ideal inversion closure of the duodenum impossible. Recourse was had to implanting the non-inverted duodenal stump into the anterior surface of the pancreas, with very excellent result.

WERTHEIM OPERATION FOR MALIGNANT ADENOMA OF CORPUS UTERI

DR CHARLES GORDON HLYD presented a woman, aged fifty-one, who entered the New York Post-graduate Hospital, November 12, 1925, complaining of bleeding from the vagina. The duration of her complaint was roughly three years. So far as the patient could recall her last regular menstrual period was three years ago. One month later she began to flow and continued to bleed for four weeks. The bleeding then stopped for two weeks and was resumed again two weeks longer. This intermittent bleeding of a week or ten days, followed by a clear interval of similar length, continued more or less constantly until about two months ago, when the patient began to have daily bleeding. The patient believes she has lost about ten pounds in weight. The patient had one child about twenty years ago, normal delivery, without any noteworthy complications. On vaginal examination the perineum was intact, the uterus was well forward and but slightly enlarged over the normal for her age.

November 13, a diagnostic curettage was done. The curette brought away a number of adenomatous appearing particles from the interior of the uterus. In the gross the curettings consisted of about five cc of material and contained numerous flakes of a faint light pink tissue. On fixed and stained specimens the pathological report showed that there was a large amount of endometrium in which the glands were giant in size, irregularly branched and lined by two or more layers of somewhat irregular columnar cells. In some places the lining was partly exfoliated. The stroma between the glands was not very abundant and there was a moderate excess of round cells and polymorphonuclear leucocytes in it. The epithelial lining of the glands showed only occasional mitotic division figures. The sections do not include myometrium and it was therefore impossible to judge as to the nature of the process in the deeper tissue. These curettings which were evidently superficial in origin, showed an enormous adenomatous hyperplasia which at this age was very suggestive of malignant neoplasm. In the absence of fibroid, such a hyperplasia of the endometrium was in itself highly suspicious. Diagnosis—a very marked irregular adenomatous hyperplasia of the endometrium.

He felt reasonably certain from a clinical standpoint that he was dealing with a malignancy of the body of the uterus and along the type of malignant adenoma. Accordingly, November 18 a Wertheim operation was performed.

HYDATID CYST OF THE LIVER INVOLVING BOTH LOBES

Very little technical difficulty was encountered. The ureters were exposed, kept constantly in sight, and all of the parametrial tissue was included with the upper portion of the vagina. The histological examination of the polypoid mass from the interior of the uterus showed that it consisted of highly irregular branching glands of the endometrium. These glands were lined by one or two layers of epithelial cells which were irregular in size and shape. Between the epithelial cells one found many round cells and polymorphonuclear leucocytes. Mitotic division figures were not very abundant. These gland alveoli were in close contact with muscle and in some places prolongations extended into the muscle bundles. The picture was not that of a fully developed carcinoma, but the lesion was that of a malignant adenoma and to be regarded as especially dangerous at this age.

DR WILLIAM CRAWFORD WHITE stated that a few years ago he did some work on curettage scrapings. It had been found necessary to have the history of the patient as well as the gross and microscopic examination of the curettings in order to make a diagnosis. One may see the same microscopic picture in three cases—and find gross evidence in the removed uterus later, find no gross but microscopic evidence in the next, and find neither gross nor microscopic evidence in the third. In the last it might be possible that a very early carcinoma was removed, but even if this is not admitted, in a suspicious case at the cancer age we are more justified in doing a hysterectomy than not doing one.

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DR CHARLES GORDON HLYD presented an Italian woman, twenty-six years of age, residing in the United States for the last twelve years, who entered the New York Post-graduate Hospital, November 2, 1924, complaining of pain in the epigastrium, eructations of gas, vomiting. X-ray examination at that time revealed a duodenal ulcer and the patient was placed upon a Sippy diet for two months. Three months later she had a reappearance of her symptoms and the same burning sensation that she had before entering the hospital. X-ray examination in February, 1925, showed that the roentgenological evidences of duodenal ulcer were much less than in the previous November and the Rontgen diagnosis at this time (February) was duodenal irritation rather than ulcer. In June, 1925, the patient returned to the hospital with marked tenderness in the right upper quadrant and a liver apparently extending about seven cm. below the costal margin. The patient entered the Post-graduate Hospital for operation, September 30, 1925, with the provisional diagnosis of tumor of the liver. October 1, a laparotomy revealed an hydatid cyst of the liver situated above the falciform ligament and involving both the right and left lobes of the liver. There were apparently two separate and distinct cysts, each twelve cm. in diameter, with the loss of about two-thirds of the substance of each lobe of the liver. On the superior surface of the left lobe-cyst were a number of daughter cysts which had broken into the peritoneal cavity. The gall-bladder had lost its color and exhibited glandular hyperplasia. The appendix was chronically infected, distorted and contained fecoliths.

The abdomen was opened by a superior right rectus incision. The falciform ligament was split longitudinally which made a right and left flap. These were brought downward and outward on either side and sutured to the

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The abdomen was opened by a superior right rectus incision. the falciform ligament was split longitudinally which made a right and left flap. These were brought downward and outward on either side and sutured to the

anterior abdominal wall which together with the round ligament of the liver made a complete diaphragm between the stomach and liver. Below this diaphragm the abdominal wound was closed. Above the diaphragm the abdominal wound was left open and iodoform gauze was inserted to the extreme right lobe of liver and to the extreme left lobe of liver for the purpose of creating adhesions between liver and anterior abdominal wall. At the end of forty-eight hours with an actual cautery through this upper aperture, the cysts were opened and probably fifty cysts of various sizes evacuated since which time the sinus has been kept open and the patient has intermittently discharged small daughter cysts. Within the last two weeks the sinus has contracted very markedly and there has been no discharge of cysts.

The interesting feature in this case is the fact that the hydatid cyst involved both lobes of the liver.

DR HENRY W. CAVE said that there is at the present time on the Second Surgical Division of the Roosevelt Hospital a young Italian man, twenty-four years of age who had right upper quadrant pains for a period of about six months. He had been in this country for two months. The physical examination was negative except for a slight icteric tint of scleræ. X-ray examinations revealed a sausage-shaped lobulated calcified area in the right lobe of the liver well outside of the gall-bladder shadow. It showed also distended gall-bladder and distorted duodenal cap. A pre-operative diagnosis was made of the calcified cyst of the right lobe of the liver, with chronic cholecystitis and peripyloric adhesions.

The operation revealed a good-sized right lobe of the liver, well up under the dome of the diaphragm. The liver was brought down and to the right side it being then fairly easily dislocated into the wound. The cyst was enucleated in its entirety. The cyst wall was thick and firm. It was really with ease enucleated. There was surprisingly little bleeding from the bed of the cyst in the liver. However, it was thought advisable to insert some gauze packing into this dead space of the liver substance.

The gall-bladder was not disturbed, it was thought they had done enough. Numerous peripyloric adhesions were found, some of which were divided. The cyst upon opening was found to be filled with smaller daughter cysts.

It has been sixteen days since this man was operated upon and except for three or four stormy days immediately following the operation, he is making an uneventful recovery.

DR ALEXIS V. MOSCHCOWITZ said that about one year ago he had occasion to operate on a case of multiple hydatid cyst of the liver as well as of the gastro-hepatic omentum which had caused such obstructive symptoms of the pylorus that a tentative diagnosis of carcinoma of the stomach was made. Whenever he has such a case of hydatid cyst and the operation is not too hazardous he attempts the removal *in toto* of the mother cyst. In view of the continuous discharge of daughter cysts in the case of Doctor Heyd the last one only four days ago, Doctor Moschcowitz is very much afraid that

RAPID FORMATION OF GALL-STONES

the secondary operation for the removal of the mother cyst will eventually become necessary

RAPID FORMATION OF GALL-STONES

DR CHARLES GORDON HEYD presented a man, thirty-four years of age who entered the New York Post-graduate Hospital, June 3, 1925, complaining of pain in the upper abdomen. Three years ago he was operated upon at Bellevue Hospital for gangrenous ruptured appendix. A year later he was operated upon at the Polyclinic Hospital for post-operative incisional hernia. For several years he has had recurrent attacks of pain in the epigastrium. The pain was periodical and recurred after each meal. May 23, 1925 an X-ray examination at Bellevue Hospital showed no defect of gastric outline but a deformity near the first portion of the duodenum with the roentgenological diagnosis of ulcer of the first portion of the duodenum. June 4, 1925 he was operated upon at the Post-graduate Hospital and on the anterior superior border of the duodenum two cm from pyloric ring a duodenal ulcer was found with about fifty per cent of pyloric obstruction. In the area of the appendectomy were numerous omental and intestinal adhesions. The gall-bladder at this time was of normal color, was palpated carefully and there were no calculi present. There were, however, a few fine, non-inflammatory adhesions between the hepatic flexure and the gall-bladder. There was no enlargement of any of the lymph-glands in Calot's triangle and the common duct was negative. A typical posterior gastro-enterostomy was performed and the abdomen closed without drainage. The patient made an uneventful convalescence and was discharged thirteen days after his operation. One month later, on the 16th of July, or forty-three days post-operative, the patient had his first attack of pain in the region of the gall-bladder. He described it as a dull ache, which lasted about eight hours. He took a bottle of magnesia that night and the pain disappeared. He was then entirely free from symptoms for three weeks, after which he again had another attack of pain which lasted eight hours. The pain came on suddenly and disappeared as quickly as it came. About three weeks later he had a third attack. All of the attacks came on at night. The intervals between attacks, however, were becoming shorter, the last two attacks coming on with an interval of four days. On Tuesday, October 13, 132 days after operation, the reporter saw the patient in his office and the man had all the clinical signs of an acute cholecystitis. There was marked tenderness and spasm in the right upper quadrant, with a temperature of 100°. November 13, a second laparotomy revealed a gall-bladder markedly contracted, the walls being about one-quarter of an inch in thickness, markedly reddened, and extremely hard. A portion of the omentum and hepatic flexure was firmly adherent to the gall-bladder. The gall-bladder contained two calculi, 1.5 cm in diameter, made up of a number of small stones firmly glued together after the fashion of a blackberry. In addition, there were about twenty smaller sized stones. All the calculi were of a bright yellow color. There was very little bile in the gall-bladder and about midway there was a raised ridge dividing the gall-bladder into two compartments. The cystic duct was surrounded by a considerable zone of inflammatory tissue and the common duct was negative. On opening the gall-bladder a gangrenous area about one-half inch in diameter, was found near the fundus on the inferior surface. An atypical cholecystectomy was performed, the gall-bladder was bisected from fundus to cystic duct and the

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mucous membrane completely enucleated, leaving the serosal investment of the gall-bladder *in situ*. A rubber tube was sutured into the remainder of gall-bladder and the cut edges brought together with No 2 chromic catgut over the rubber tube much after the fashion of a primary cholecystotomy. The abdominal wound healed rapidly and biliary discharge ceased on the sixth day and patient left the hospital at the end of two weeks.

The interesting features of this case appear to be as follows. At his operation on the third of June he had to all intents and purposes an apparently normal gall-bladder and a simple posterior gastro-enterostomy was performed. The patient left the hospital thirteen days after operation and one month later was complaining of an entirely different group of symptoms consisting of pain in the region of the gall-bladder, with strong predilection for nocturnal occurrence, and at the end of six weeks from the time he left the hospital was having attacks in every way typical of gall-bladder colic. In other words, a clinical picture of cholelithiasis, fifty-five days after his first operation. Doctor Heyd being unwilling to concede a possible infection of the gall-bladder, treated him symptomatically throughout September and a portion of October. When he was seen at the termination of an attack November 11, 130 days after his operation, there could be then no question as to the diagnosis of cholecystitis. At operation there were found two calculi of sufficient size to warrant the assumption that they could not possibly have been overlooked at the previous operation. It would seem that the mechanism for the production of these calculi was an infectious embolus from the gastro-enterostomy with hepatic infarct, later an infection of the liver and a sequential lymphangitis, with secondary infection of the gall-bladder and calculi formation. The composition of the gall-stones of cholesterol with some slight degree of calcium and bile pigment suggests the ease with which they could reform. The gangrenous process in the gall-bladder also speaks for the intensity and rapidity of the cholecystitis. It would seem that the belief is warranted that formation of gall-stones can occur in a much less time than has heretofore been supposed. In a paper in the *Journal of the A M A* November, 1923, Angus L. Cannon reported a case of chronic cholecystitis with drainage, and eighty-six days post-operative a secondary operation revealed thirty-eight irregular calculi, consisting of cholesterol, calcium and bile pigment. It is interesting also to note that at the second operation on November 13, there was no visible residue of his previous duodenal ulcer. The most that they could find was a small point about three mm. in diameter, which had a slightly bluish tinge when the duodenum was put on tension so as to render it anæmic.

DR FRANZ J. A. TOREK said that it was very difficult to determine how long ago these gall-stones originated. The fact that no stones could be felt at the previous operation was not sufficient proof that none were present. He had more than once found the following condition. In a given gall-stone case he may have felt one or two stones, but in spite of careful palpation could not make out any others. On opening the excised gall-bladder, however, a number of very small stones would be found in folds of the mucosa in addition to those that were felt through the walls of the gall-bladder previous to its removal. In the case of calculi of one or two millimetres in diameter he believed that palpating skill was not always reliable.

DR EDWIN BERR said that there was no doubt that pathological studies as well as experimental studies showed that stones could form within less

FREE TENDON GRAFTS FOR LOSS OF EXTENSOR TENDONS

than six weeks in the biliary or urinary tract. Primary, non-inflammatory stones of a pure cholesterol structure—as this was said to be in Doctor Heyd's case, had, however, never been reported as far as the speaker knew the literature, precipitation stones apparently being quite different from stones which are of an inflammatory origin.

DR JOSEPH WIENER remarked that it had been shown experimentally that gall-stones can be formed in forty-eight hours by annoying animals. A squirrel in a cage was annoyed for hours at a time and it was found that stones would form in a few days. So that it is not far fetched to deduce that gall-stones can be formed in the human gall-bladder in much less than ninety days.

PLASTIC FOR EFFECTS OF EXTENSIVE BURNS OF THE FOREARM AND WRIST

DR H. H. M. LYLE presented two patients, a man and a woman, to contrast the methods of treatment of burns. The woman, at the end of eighteen months, after much pain and suffering, has an unsightly and useless hand with a complete posterior dislocation of the thumb and unhealed nutritional ulcers. The man, with an extensive lesion reaching from the palm to the shoulder, was healed in forty-three days. The method of treatment in his case was prompt sterilization of the ulcerating area and the appliance of Ollier-Thiersch grafts. He has a useful arm and hand and is back at work. They had expected that they might have to excise some of the Ollier-Thiersch graft and replace it with a pedunculated flap—but this has been unnecessary as the prompt covering of the ulcerating area with the graft has greatly reduced the amount of cicatricial tissue.

The method of treatment in the woman was exactly the reverse: the burns were treated in the usual way with ointments, etc., and when it was discovered that keloid formations were becoming excessive, the tissues were further insulted and devitalized by radium. What was the result? The poor woman's hand and arm became incased in the grip of a vice-like cicatricial contraction, which seemed to have taken malignant joy in squeezing the nutrition out of the arm.

It was necessary to excise the encasing cicatricial tissue for more than three-fourths of the diameter of the arm and from the elbow to the second joint on the thumb. The dorsal dislocation of the thumb had also to be corrected. The patient now has a useful functioning hand, with good prehensile action of the thumb, strong grasp, and complete fist.

FREE TENDON GRAFTS FOR LOSS OF THE EXTENSOR TENDONS OF THE HAND

DOCTOR LYLE presented a third patient to show the value of skin plastics used in series. In June, 1924, this patient had all the soft structures of the back of the hand, including the extensor tendons torn away. Eight days after the accident he entered Doctor Lyle's service at St. Luke's Hospital. The wound was infected. The skin on the dorsum was absent, there were no tendons, the metacarpals were bare. The fifth metacarpo-phalangeal joint was open and the finger dislocated. The wound was debrided and treated by the Carrel method. At the end of three weeks a pedicle flap from the abdomen was applied to the back of the hand. Failure due to an erysipeloid infection. The flap was cut away and the Carrel method started again. In

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September, the area was covered with an Ollier-Thiersch graft. The wound healed completely with the exception of a very small area over the third metacarpal. In October a scale-like bone was removed, and this was followed by a second erysipeloid flare-up. By the end of two weeks the wound was closed. In January, the Ollier-Thiersch graft was excised and a pedicle flap from the abdomen was sutured in place. In March, a free transplantation of the tendons from the long extensor of the foot into those of the back of the hand was made.

The remaining portion of the extensor tendons were exposed in the fingers and in the arm above the flap, the flap was then tunnelled and the tendons from the foot inserted and sutured. The functional result is very satisfactory. The grasp, and the extension of the fingers is notable. He is now earning his own living and has a useful functioning hand.

A PLEA FOR EARLY AND MORE FREQUENT USE OF SKIN PLASTIC IN THE TREATMENT OF TRAUMATIC LESIONS OF THE HAND AND FOREARM

DR HENRY H. M. LYLE read a paper with the above title, for which see page 537

Stated Meeting Held January 13, 1926

The President, DR WALTON MARTIN, in the Chair
TRAUMATIC BONE SARCOMA

DR WILLIAM B. COLEY presented the following cases as definite examples of acute traumatic malignancy, in which the history is so clear and positive that it leaves no reasonable doubt that the trauma was an important causative factor.

CASE I *Sarcoma of Occiput*—W. B., male, twenty-eight years old, was admitted to the Hospital for Ruptured and Crippled, October 4, 1925, to the service of Dr. J. P. Hogue. The patient gave a very lucid and connected account of an injury and the subsequent developments. He was employed as receiving clerk in the warehouse of a big department store. On the morning of June 22, 1925, while checking alone the invoice numbers of some crated goods which had just been unloaded on the sidewalk in front of the store, he was struck on the head by a falling piece of furniture. The patient did not fall to the ground but was dazed for a moment. The scalp was not broken but a small hæmatoma formed on the upper occipital region. He continued with his work, but during the remainder of the day he felt nauseated, he did not vomit. Finally he became so uncomfortable that he left for home about two hours before the usual quitting time. He went to bed at 8 o'clock that evening, instead of at his customary retiring hour, between 10 and 11 o'clock. He returned to work on the following morning, but suffered from a disagreeable headache throughout the entire day. The same situation continued for three days when, June 25, he reported his condition to his superintendent, who advised him to consult the company physician. This he did. The swelling on the back of his head gradually increased until it had reached the size of half a hen's egg. The physician advised an incision, which he proceeded to do but did not complete on account of lack of instruments. He advised the patient to return on the following day in order that he might

TRAUMATIC BONE SARCOMA

open up the swelling. On the following day, however, he referred the patient to the physician of the Insurance Company, who advised him to return home and bathe the part with hot water. The swelling decreased in size so that at the end of fifteen days it had nearly subsided. His headaches, however, continued intermittently. About two weeks later, the injured area began to increase in size, and in the last week of September, while seated at a table, everything went black before his eyes and he could not see for about twenty minutes. His headache returned, and he became nauseated but did not vomit. He was unable to report for work on the following day. The next day he returned to the Insurance Company physician who had some X-ray pictures taken and then referred the patient to Dr. Walter Jones. Doctor Jones incised the swollen area while the patient was in his office, but on account of the severe hemorrhage, applied a dressing and sent him to the Hospital for Ruptured and Crippled.

Doctor Hoguet, on October 7, 1925, made a free incision over the swelling, which, by this time measured $3\frac{1}{2}$ –4 inches in diameter, and protruded for about 2 inches beyond the normal surface of the skull. The tumor was soft, semi-fluctuating in consistence, and had all the characteristics of a hæmatoma. On cutting into it, the hemorrhage was very profuse, and the examining finger revealed complete destruction of both tables of the skull, the finger being able to pass down to the dura. The hemorrhage required tight packing, which was left in for nearly two weeks. On the second post-operative day, the patient was turned over to Doctor Coley for treatment.

Microscopical diagnosis by Doctor Jeffries: Spindle-cell sarcoma. Doctor Ewing's microscopical report stated: "Small spindle-cell sarcoma, very vascular, no bone formation, probably an osteogenic tumor arising from periosteum."

X-ray plates made before the operation showed complete destruction of both tables of the skull over an area $4\frac{1}{2}$ inches in diameter. The patient was immediately put upon the mixed toxins of erysipelas and bacillus prodigiosus, systemically, the dose being increased up to 5 minims, which produced a reaction-temperature of 104–105, after which, an injection every other day instead of daily was given. The radium pack, consisting of 10,000 mc. hours was applied on October 21, and again on November 11, and on November 25, the three treatments totalling 30,000 mc. hours.

The soft part of the tumor rapidly disappeared, and the large cavity in the skull at the site of the operation filled in with normal granulations. The wound had entirely healed by the middle of December, and has remained healed since, there is practically no deformity at the present time, the patient's headaches have disappeared, and his general condition is good.

This case is not shown with reference to any effect of treatment—it is much too early to say anything as regards the prognosis—but is shown as an example of definite acute traumatic malignancy.

CASE II Osteogenic Sarcoma of Femur Following Trauma—I. L., male, twenty years old, chauffeur, was admitted to the Hospital for Ruptured and Crippled, March 13, 1925, with the following history:

In March, 1921, four years before, the patient's left leg was caught in the closing door of a subway train, severely squeezing the thigh. He was able to walk and did not notice anything unusual until three days after, when he began to feel severe pain in the thigh just below the great trochanter, at the site of the injury. The pain was intermittent at first, keeping him in bed for a few days at a time, but later the attacks became more frequent. A swelling

was noticed which gradually increased in size. He was admitted to the Jewish Hospital of Brooklyn, July 25, 1923, where an operation (osteotomy and curetting of bone) was performed August 7, 1923. Microscopical report: "Specimen consists of degenerated soft tissue in which there are embedded small pieces of sclerotic bone tissue. Microscopical diagnosis: Osteomyelitis of left femur." Physiotherapy treatment was begun in the latter part of 1924. A slide from the original specimen was obtained from the Brooklyn Hospital and submitted to Doctor Jeffries, who pronounced it productive osteitis. Doctor Ewing, who also examined the slide, concurred in the diagnosis and said that one edge of the specimen showed a slight suspicion of possible neoplasm, but not enough on which to make a diagnosis.

An X-ray picture taken two years ago showed nothing at all suggestive of sarcoma, there was a marked thickening of the femur with sclerosing of the bone, typical of a chronic sclerosing osteitis.

An X-ray picture taken on his admission to the Hospital for Ruptured and Crippled, two years later, showed that certain changes had taken place since the last picture was made: the bone was larger and thicker than it was at that time, the density seemed not quite so marked, instead of the periosteal line of the bone being intact, there were a few erosions in one area—a few indentations in the normal outline, apparently there was a small amount of new bone production beyond this normal line. The picture, however, did not permit one to make a diagnosis of sarcoma, although it was more suspicious of sarcoma than the earlier pictures.

The patient was admitted to the service of Dr. Royal Whitman (Hospital for Ruptured and Crippled), by whom an exploratory operation was performed March 16, 1925. On cutting through the muscle some soft, vascular tumor tissue was found which had broken through the periosteum.

Microscopical report by Doctor Jeffries: Mixed-cell sarcoma. Microscopical report by Doctor Ewing: Osteogenic sarcoma, polygonal cell, malignant.

The mixed toxins of erysipelas and bacillus prodigiosus were begun on April 1, 1925, and daily increasing injections were made in the buttocks, up to the point of producing a severe reaction, temperature of 103–104°, after which an injection only every other day was given. The treatment was kept up for nearly two months, the highest dose given being 15 minims. At the end of six weeks' toxin treatment, the circumference of the thigh had diminished two inches, and the patient's general condition had shown marked improvement.

Low-voltage X-ray treatment was begun at the Memorial Hospital by Doctor Heerden on May 7, 1925, from then until November 13, 1925, he received seven exposures of sixty minutes each.

By June 18, 1925, he had gained 17 pounds in weight, and the leg measured the same size as the other one. He has remained in good health, and has gained about 35 pounds in weight since the treatment was begun. As far as the present X-ray pictures show, there is no definite evidence of sarcoma. Inasmuch as not quite a year has elapsed, it is much too early to say anything definite as to the prognosis. It should be borne in mind, however, that most cases of periosteal sarcoma show evidence of pulmonary metastasis at the end of one year.

This case was presented with special reference to traumatic origin rather than to results of treatment. In contradistinction to the first case, there was a long interval of time, nearly four years, before the neoplasm was recognized. The question arises, whether a sarcoma developed shortly after the injury

TRAUMATIC BONE SARCOMA

and progressed very slowly for several years before being recognized, or, whether a chronic osteomyelitis developed at the site of the injury, which, four years later furnished a favorable site for the development of a malignant osteogenic sarcoma. It is extremely difficult to decide which of these two theories is the correct one. In the present case, Doctor Coley was inclined to believe that the earlier process was an inflammatory osteomyelitis or productive osteitis which later furnished a favorable soil for the development of a sarcoma.

If we accept the theory that sarcoma and malignant tumors in general are due to a microorganism or virus—and personally he firmly believed that the research work of Glover, of New York, Nuzum, of Chicago, Young, of Edinburgh, and Gye and Barnard, of London, had practically proved this theory to be correct—then the question of whether the earlier condition in the foregoing case was an osteomyelitis or a latent sarcoma becomes one of academic interest solely, for then it would be a question merely of whether they are dealing with two different types of organism or a single one.

CASE III *Periosteal Osteogenic Sarcoma of Femur*—H. S., male, nineteen years old. Family history negative. In the beginning of 1920 he had a fall, one month later he noticed pain in the right popliteal space. This was regarded as of rheumatic origin and was treated with local applications. Two weeks later a swelling was noticed on the outer aspect of the femur just below the knee-joint, this steadily increased in size. The pain became very intense, necessitating two treatments with small doses of radium. He was referred by Dr. H. Hallerman, of New York, April 23, 1920, at which time he was admitted to the Hospital for Ruptured and Crippled.

On admission there was enlargement of the lower end of the femur most marked in the region of the outer condyle, extending to the popliteal space and upward for a distance of three inches. It was, apparently, of bony origin, firm in consistence, but not of bony hardness. The leg could be flexed almost to a right angle. The pain had diminished somewhat since the radium treatment. He was put upon systemic injections of the mixed toxins at once, these were given three or four times a week. At the end of three weeks, there was definite decrease in the size of the leg. The toxins were continued regularly until early July, when a slight increase in the size of the tumor was noticed. He was transferred to the Memorial Hospital where the radium pack was applied (total of 20,958 mc. hours) over two areas, at 6 cm. distance. He returned to the Hospital for Ruptured and Crippled and the toxins were resumed in doses up to 24 minims without marked reaction. While the tumor showed some diminution in size, the improvement was only temporary, and it again began to increase, there was considerable synovitis, and the X-rays showed an extension of the disease higher up in the femur with an increase in thickness and greater destruction of the dense tissue of the bone itself. The patient finally consented to an amputation which was performed, just below the trochanter, in August, 1920.

Microscopical examination by Doctor Jeffries showed the tumor to be a "periosteal neoplasm, apparently originating in the popliteal region and extending nearly around the femur."

Microscopical report by Doctor Ewing: "Malignant spindle- and giant-cell osteogenic sarcoma. There is considerable production of osteoid tissue in marrow regions. Many areas of hemorrhage and some points of mucoid

degeneration appear. There are some broad areas of hyaline material without cells. Radium effects may be traced in the hemorrhages, mucoid degeneration, irregular calcification, and general hyperchromatosis of tumor-cell nuclei."

The man made a good recovery from the operation. The toxins were resumed and kept up with occasional intervals of rest for six months. He has remained in excellent condition up to the present time, January, 1926, five years later.

Doctor Coley remarked that this case, while a true example of acute traumatic malignancy, the symptoms developing one month after the injury adds one more to the very limited number of cases of osteogenic sarcoma that have recovered under any method of treatment and remained well for a period of five years. Doctor Coley has twenty cases of periosteal sarcoma, including five cases treated by other men under his direction, in which the toxins alone were used and the patients are alive and well from five to twenty-eight years later, in eight of these cases the limb was saved, in addition, he has fifteen cases treated with a combination of toxins and radium or X-rays that have remained well from four to fifteen years, in six of these cases the limb was saved. The present case, he believes, furnishes additional proof of the value of the mixed toxins of erysipelas and bacillus prodigiosus as a prophylactic after amputation. Doctor Coley stated that he had never succeeded in curing a case of osteogenic sarcoma by amputation alone, and Bloodgood has stated that amputation alone is able to cure not more than 1 or 2 per cent of these cases. Therefore, Doctor Coley believes it of special importance to note that of thirty-eight cases of periosteal sarcoma treated by amputation followed by prophylactic toxin treatment, 50 per cent have remained alive and well from three to eighteen years.

DR. WALTER A. SHERWOOD said that he would like some advice regarding a case he had now in the Brooklyn Hospital. This is an infant three months old, who came in with a deformity of the tibia resembling rickets. The radiographer interpreted the X-ray as bone cyst. Further study made it appear to be a bone abscess. It was thought advisable to investigate and the tibia was explored, the periosteum cut through and the cortex was easily entered. Some soft grayish-brown material was removed and the wound was closed. The material was sent to the laboratory for diagnosis and the report came back spindle-cell sarcoma. It had been assumed that amputation should be done but the mother had not consented, and as the speaker doubted the wisdom of an amputation in such a case, it was on this point he wished Doctor Coley's opinion. Doctor Sherwood showed a child at a meeting of this Society in February, 1923, who had an osteogenetic sarcoma of the humerus of intra-uterine origin. In this case disarticulation was done at the shoulder-joint and the child is now living and well, almost six years after operation. Sections of the tumor in the case were examined by Doctors Ewing, Bloodgood and Denton and the case is included in the Codman registry of bone sarcoma (No. 68).

DOCTOR COLEY, in closing, stated that these cases were presented not so

much to exemplify the results of the treatment employed, but because of the growing medico-legal interest in the question of the traumatic origin of tumors. He stated that at present there was the greatest difference of opinion among surgeons and pathologists on the question of trauma as an etiological factor in the development of malignant tumors. Most surgeons have given the matter little consideration, and most pathologists claim that trauma plays little or no part. Doctor Coley believes no surgeon who has an opportunity of seeing a considerable number of bone sarcomas can fail to be impressed with the large number of cases in which there is a definite history of antecedent local injury. In an early report of 170 cases of sarcoma personally observed (ANNALS OF SURGERY, 1898), he had noted a history of antecedent trauma in 46 cases. In a later report (ANNALS OF SURGERY, April and May, 1911), covering a total of 970 cases of sarcoma personally observed, a definite history of trauma was noted in 225 cases, or in 23 per cent. It is interesting to note that the tumor developed within the first month after the injury in 117 of these cases. Doctor Coley stated that before the last meeting of the Southern Surgical Association in Louisville, he had presented a paper on "Injury as a Causative Factor in Malignant Tumors," with special reference to bone sarcoma. Since his publication of 1911, he had observed 117 cases of sarcoma of the long bones in which there was a definite history of antecedent local injury. In a group of 50 giant-cell tumors (reported in the ANNALS OF SURGERY, March and April, 1924) he had found a history of antecedent local trauma in 56 per cent of the cases. The periosteal group showed a slightly larger percentage.

DOCTOR COLEY stated that Doctor Kolodny had read an important paper on "Bone Sarcoma" before the American Orthopædic Association in Washington last May, this was based on a study of twenty-five cases. This author found that the patients whose ages ranged from ten years and upward showed a history of antecedent local injury in 70 per cent. Within recent years, a number of cases have been tried before compensation bureaus and courts and the decisions rendered showed diametrically opposite opinions on the question.

Regarding Doctor Sherwood's patient, Doctor Coley said he believed amputation should be performed followed by several months' prophylactic treatment with the mixed toxins of erysipelas and bacillus prodigiosus. In a child of this age, he would advise beginning with one-half minim diluted with a little freshly boiled water. Doctor Coley stated that the youngest patient in which he had used the toxins was a child of two months with a sarcoma of the scapula, referred to him by Dr. V. P. Gibney. While in this case there was no microscopical examination, the tumor involved almost the entire scapula, it was of bony origin, apparently periosteal, the superficial veins were markedly dilated and the clinical and X-ray evidence left little doubt as to the correctness of the diagnosis. This patient was treated with toxins alone for nearly a year. He made a complete recovery and was alive and well more than six years later.

Later Note—After the meeting was over, Doctor Coley made a closer

study of the pictures of Doctor Sherwood's case, in view of the location of the tumor (central portion of the tibia) and the absence of much new bone formation, he believed it to be probably an endothelioma, a type in which the limb had been saved in a number of cases by the use of the toxins alone or combined with radium. In this case, Doctor Coley believed it would be worth while trying conservative treatment for three or four weeks before amputating.

FRACTURE OF NECK OF FEMUR RECONSTRUCTION OPERATION

DR WILLIAM CRAWFORD WHITE presented a woman, fifty-one years of age, who was admitted to Roosevelt Hospital, May 11, 1923, with a subcapital fracture of the neck of the left femur. Under anæsthetic she was placed in an abduction plaster spica. The entire case was removed on the eighty-ninth day. A month later she went home on crutches. At the end of six months she began to bear weight on the limb. One year after the accident the X-ray showed much absorption of the neck. She had severe pain whenever she took a step, no voluntary flexion, with leg extended abducts 30 degrees. There was a shortening of about one inch. May 28, 1924, the Whitman reconstruction operation was followed, except that it was changed to a degree that a removable nail was put through the greater trochanter into the femur. Case removed at the end of forty-two days. Three months and a half later she walked with a cane, gradual improvement since. Now can walk a mile without discomfort. Flexes thigh none, abducts 30 degrees. The result is definite relief of pain and a little motion at the hip. She now does light work.

DR ROYAL WHITMAN said that he was, naturally, very much pleased to see such a convincing demonstration of the utility of the reconstruction operation for ununited fracture at the hip. He thought that non-union after efficient treatment by the abduction method indicated such impaired nutrition that direct union of the fragments by further operative procedure was extremely doubtful. In these cases and in all those in which the neck of the femur had been destroyed, the reconstruction operation was indicated because the result could be depended on, a result that even from the functional standpoint was as good, or better, than to be obtained by bone grafting, even if successful. He said he would like to correct what seemed to be the impression that he had claimed that union in fracture of the intracapsular type could always be obtained by efficient treatment. He thought union in such fractures might be predicted in the larger proportion of cases, and that all should be treated in a manner to assure the opportunity for success. Furthermore, since the transcervical fracture were in the minority, the prognosis in general, even from the functional standpoint, was now distinctly favorable.

Under the old system all varieties of fracture had been equally neglected, because it was assumed that one type was incapable of repair. He would conclude with a positive statement supported by both technical analysis and by comparison of results, that there was but one treatment for fracture of the neck of the femur and the only question was of the ability of the surgeon to apply it.

PLASTIC ON THE HEEL

PLASTIC ON THE HEEL

DR JAMES MORLEY HILZROT presented a man, aged twenty-one, who was admitted to the New York Hospital, October 29, 1924, with a history of having had his right heel caught in an elevator. On admission it was found that the entire subcutaneous tissue had been stripped off the heel from the level of the malleoli down just beyond a line drawn through the base of the fifth metatarsal. The skin flap was stripped from the bone and on the outer side the sheath of the peroneus tendons had been opened. There were some small abrasions over the skin above the external malleolus extending about 2 cm above the tip of the bone, and the edge of the flap contained ground in dirt.

The patient was taken to the operating room and the contaminated tissue excised, the wound thoroughly washed with saline solution and the skin flap loosely approximated around the heel. There was very little evidence of any vitality in the posterior half of this long flap. On the day after his admission the edges of the skin flap had become dusky and the whole flap gradually became bluish-black in color and had to be excised. This left a denuded area which practically involved the entire os calcis, and the sole of the foot as far forward as the base of the fifth metatarsal. The foot was dressed by the Carrel method with Dakin's solution until the 25th of November, 1924, when a plastic operation on the heel was done. The denuded area on the sole of the foot and heel was prepared by dissecting off the granulation tissue and freeing the skin edges down to the normal healthy granulation tissue. A flap of skin and subcutaneous fat was then dissected upward from the outer aspect of the left thigh, leaving a broad pedicle attached at its upper margin. The right heel was then placed across the left thigh and the pedicle flap, previously prepared, fastened over the denuded area on the right heel and fixed into position by interrupted silkworm and horse-hair stitches. The flap was so placed that it covered the sole and most of the heel, special care being taken to cover in the posterior and weight-bearing aspect of the os calcis. The denuded area from which the flap had been dissected was partially covered by a few Thiersch skin grafts removed from the opposite thigh and the denuded area dressed with vaseline gauze. Vaseline gauze was also placed over the skin flap and the right leg was fastened to the left leg by a bulky dressing and plaster bandage which extended about both legs, girdling them so that the foot was held fairly rigidly in position. The flap healed in position fairly rapidly and maintained its circulation except at one small area just below the external malleolus, where about one-half cm of the flap dried up. Twelve days after the operation a temporary constriction was placed across the pedicle in order to ascertain whether the circulation was sufficient. As it seemed a little doubtful, it was left two days longer, when a temporary constriction was again placed across the pedicle and the flap seemed to retain its circulation. It was then detached from the thigh and attached to the denuded area by interrupted silkworm gut stitches. The flap healed without subsequent complications, except for a small blister in the skin just below the area beneath the external malleolus which had dried up. This skin bleb was opened and disappeared without further complications.

The patient was discharged from the hospital, December 2, 1924, with all the wounds healed except a small area just below the tip of the external malleolus, and this eventually healed and left the foot in approximately its present condition.

This case illustrates the method of placing a skin flap over the os calcis

through the opening. As the stomach had been thoroughly lavaged before operation, there was nothing in the stomach or duodenum. The adhesions seemed to have been the cause of the obstruction, and it was hoped that these having been separated, the ileus would be relieved, but a duodenal tube was passed from the mouth and brought into the distal loop of the jejunum with the idea of feeding him through that. There was no vomiting for a few days, but on aspiration some bile was obtained on the third day after the second operation and he started to vomit and burst part of the wound open, and something, either stomach or intestinal wall, was projected. He was opened up again and more adhesions found and the viscus that was projecting was found to be part of the stomach wall. The jejunum was distended and there was local peritonitis around that area. At this time a jejunostomy was done. He was in bad condition, with a blood urea of 65, and he died the following day. The obstruction was due, probably, to contamination, perhaps from some leakage from the original ulcer, which caused dense adhesions in this region. In such cases of so-called vicious circle, if found early by X-ray, it might be possible by duodenojejunostomy to relieve the condition, when the obstruction is at the duodenojejunal angle, as is sometimes the case, as the ordinary jejunojejunostomy would be of no avail.

DR. WALLER M. BRICKNELL related the history of a young married woman with gastrioptosis who had been vomiting for about eight years and had become much emaciated. Fluoroscopy showed dilatation of, and retrograde peristalsis, in the duodenum. No relief had been obtained with medical treatment. Operation revealed obstruction at the duodenojejunal angle and very evident dilatation of the duodenum. In addition there were some adhesions between the duodenum and the gall-bladder, but the latter was otherwise apparently normal. Duodenojejunostomy was easily performed and gave prompt relief. The patient gained steadily in weight and ceased vomiting. Seen recently, two years after the operation, she is in excellent health and has no vomiting or other symptoms.

DR. ALFRED S. TAYLOR said it was not a logical procedure to do a gastro-enterostomy for obstruction at the end of the duodenum. With regard to the statement that there is no authentic case of cure from duodenojejunostomy, Kellogg has reported several, in fact, a series of 40 to 150, in a large number of which the results have been very good. The speaker said he had had cases where there was chronic duodenal obstruction in which duodenojejunostomy did very well. It seemed to him that one ought to be clear as to which method to choose, but personally he preferred duodenojejunostomy to gastro-enterostomy.

DR. HERMANN FISCHER said that he had occasion to operate in two cases for a duodenal obstruction at the duodenojejunal angle. The first patient was a woman which the speaker had presented to the Society several years ago. She had been in the medical ward for observation on account of continuous occult hemorrhages resulting in a severe secondary anemia. X-ray examina-

which will permit of weight-bearing without the constant difficulty experienced with those cases which are skin-grafted. It also demonstrates the efficacy of the ordinary rubber sponge placed in the heel to compensate for the loss of the fat commonly present in the heel after flap transplant.

Habhegger (*ANNALS OF SURGERY*, 1908, vol. xlviii, p. 909) used this method, although Doctor Hitzrot was unaware of it at the time of his operation.

Doctor Hitzrot stated that he had used these methods in three cases, all of which have been quite satisfactory.

FRACTURE-DISLOCATION AT THE SHOULDER-JOINT

DOCTOR HITZROT presented a man, aged forty-two, who was admitted to the New York Hospital, June 9, 1924, with a history of having been



FIG. 1.—Fracture-dislocation of head of humerus

knocked down by a horse two days previously. He landed on his right shoulder. The arm was immobilized by his doctor, who had an X-ray taken, which showed a fracture-dislocation of the head of the right humerus (Fig. 1). On admission to the hospital his shoulder was markedly swollen with a very considerable subcutaneous hemorrhage which extended over on to the chest. It was not possible to locate the head of the bone by the examination. The X-ray showed a subcoracoid dislocation of the head of the humerus with a line of fracture involving the greater tuberosity.

June 10, 1924, a four-inch incision was made over the anterior portion of the shoulder-joint, splitting the fibres of the deltoid muscle. There was exposed a fracture through the anatomical neck of the humerus, taking with it a small portion of the greater tuberosity and a portion of the bicipital groove. There was also a separate fracture of the greater tuberosity and the upper end of the lower fragment lay to the outside and above the head, which was displaced forward with its fractured surface resting against the edge of the glenoid fossa (Fig 1). The subcapsularis muscle and the tendon of the long head of the biceps were wrapped around the displaced head. The subcapsularis muscle was divided after which it was possible to liberate the head. The head fragment was then found attached by the tendons of the supraspinatus muscle and was removed as the circulation was completely cut off. The divided supraspinatus attachment and the capsule of the shoulder-joint were then closed by chromic stitches and the end of the humerus placed in contact with the glenoid fossa. The capsule of the shoulder-joint had been torn loose from the glenoid fossa on its anterior surface, and no attempt was made to repair this rent but the excess of the capsule was sutured to the bone and to the capsular portion of the expansion of the supraspinatus tendon by interrupted chromic stitches. The greater tuberosity was fastened to the shaft by chromic stitches and the wound was closed without drainage using silkworm in the skin and the arm put up in abduction to a right angle, with the forearm in sufficient external rotation to be parallel to the long axis of the body, in a suspension apparatus.

The man was instructed to move the arm on the day following the operation. He was out of bed on the second day after the operation, with the arm suspended and practiced shoulder movements within the limits of pain, lowering and raising the weight over the pulley. He left the hospital seventeen days after the operation with little or no voluntary motion in the arm. He was instructed to use the apparatus (suspension and weight and pulley) at home and in ten days (twenty-seven days after the operation) had about ten degrees of voluntary abduction and about five degrees of rotation each way. One month later this had increased and he was given exercises with dumb bells. Throughout the patient cooperated and made every effort to get as good a result as was possible.

June 21, 1925 (Fig 2), a little over six months after the operation, he had reached his present function. The arm can be abducted alongside the head to within 10 degrees of the opposite arm. The arm can be extended in front of the body to within 10 degrees of the other arm. External rotation is less than the other arm by five degrees. Internal rotation is less than the other arm by 20 degrees. The man states that he uses his arm for everything he used to do just as well as he ever did, except that he cannot get it quite as far up on his back (loss of internal rotation). All the motions are shoulder-joint motion, the scapula does not begin to move any sooner on the affected side than it does on the normal, that is, the motion is not scapular motion.

DOCTOR HITZROT presented a second case, in the person of a woman, who was admitted to the New York Hospital, December 16, 1925. Six days before admission she fell down a flight of stairs, injuring her right arm, which was immediately disabled. Her physician found the arm extremely swollen and was unable to determine the nature of the injury. X-rays were taken which showed a fracture-dislocation of the right shoulder with the head fragment in the subacromial region with the greater tuberosity split off as a separate fragment. On admission an unsuccessful attempt was made (by traction and suspension) to pull the fragments into position.

December 19, 1925 (nine days after the injury), a four-inch incision was made from the acromio-clavicular joint down the arm, splitting the fibres of the deltoid muscle. The upper end of the lower fragment lay below the glenoid fossa in the axilla. The head fragment lay posteriorly under the acromion process. The joint capsule had been extensively torn, especially on its lateral and posterior surface and the head had evidently been driven through this opening in the capsule. The greater tuberosity and a portion of



FIG. 2 —Seven months after operation

the shaft with the attachment of the external rotators of the arm had been split off as a separate fragment and was displaced posteriorly and to a certain degree downwards in the relationship with the glenoid fossa. There were a number of other pieces of bone evidently split off from the shaft fragment. The head fragment was also broken and was so rotated that what normally was the anterior and inferior border of the bone had been completely turned around so that it faced upward and outward. It was completely loose and had no vascular attachment. The head was removed. The upper end of the lower fragment was smoothed off with a rongeur. The line of fracture apparently involved the quadrilateral portion of the bone before its expansion into the head. The greater tuberosity with the attached bone was then sutured to the shaft fragment by a few sutures passed through the tendon attachments.

FRACTURE-DISLOCATION AT THE SHOULDER-JOINT

and the periosteum of the tuberosity and the peritoneum of the lower fragment. The upper end of the lower fragment was placed in the glenoid fossa in contact with the cartilaginous surface of the scapula. The capsule of the shoulder-joint was then loosely closed with interrupted chromic with some difficulty due to the extensive laceration and the subsequent infiltration of the tissue. The deltoid muscle was loosely closed with plain catgut and the skin with clips. The arm was put in external rotation with abduction to a right angle with the body and suspended in the overhead position.

The woman was started on active motion by means of pulleys, immediately after she recovered from the anæsthetic, within the limit of pain. She had a temperature reaction to 102 degrees on the day after operation, but this immediately came down and has not been up since. She continued to move the arm, increasing the range of motion each day. On the eighth day after operation the patient was allowed out of bed with her arm in a sling and was given instructions to move it as much as possible with the aid of the suspension apparatus. This she has been doing until the present time.

The case is now on the twenty-sixth day after operation. There is no voluntary motion at the shoulder except in very slight abduction and external rotation. On guided motion the arm can be abducted to a right angle with the body and through about one-half the normal arc of external rotation without moving the scapula. The case is shown as an early result and also as an uncommon form of fracture-dislocation of the head of the humerus.

These two cases were shown to advocate excision of the head of the bone and early active motion in fracture-dislocations of the head of the humerus. The essential points in the after-treatment are the effort, position of the arm and the use of the suspension apparatus with the pulley, and the movement of the arm by the patient. The original movements are essentially passive as the patient guides the arm or the weight with the opposite arm.

The first case Doctor Hitzrot considered a 100 per cent result for this type of injury, and it was obtained very largely through the cooperation of the patient and shows very clearly how important a factor the willing effort on the part of the patient is.

Doctor Hitzrot has operated upon eighteen cases of fracture-dislocation of the shoulder in which the fracture line separated the head fragment through the anatomical neck or very closely followed that line. In these two cases were replaced in the glenoid cavity and produced an entirely stiff shoulder. Doctor Hitzrot has also seen a similar result in a case done by Dr. Seward Erdman, and also a fourth case in consultation with Dr. A. E. Hoag. The head of the bone in all the above cases was surrounded by mushroom mass of bone with apparent calcification of a portion of the joint capsule and all the patients had painful stiff shoulders. Of the sixteen cases treated by excision of the head of the humerus and the procedure used in the two cases shown, four cases could not be found, of the remaining twelve cases—one is the case shown here and which is used as the 100 per cent result and the other is too recent for a final rating. Of the remaining ten cases five had a 75 per cent result of the case shown here and one had a 60 per cent result and four had a 50 per cent.

DOCTOR HITZROT also showed the lantern slide of a fracture-dislocation in which the line of fracture involved the upper one-third of the humerus below the neck and in which the dislocation was subcoracoid and stated that such cases could be reduced by a very simple open operation by grasping the shaft with a Lambotte forceps and replacing the head and then by subsequent treatment for the fracture.

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By far the most frequent variety of fracture-dislocation is, however, found in the group shown by these cases and for that type Doctor Hitzrot wished to combat the statement that excision of the head was followed by a bad shoulder and that replacement of the head was the correct procedure

DR ROYAL WHITMAN said that in fracture at the shoulder-joint motion was preferable to union and fixation. He thought therefore that in this case in which the head of the bone was completely detached it should be removed. Subsequent function depended largely on the range of abduction, and this was determined primarily by the preservation of the attachments of the scapular muscle and by supporting the arm in full abduction during convalescence.

CAVERNOMA OF THE THIGH

DR JAMES M. HITZROT presented a woman, aged forty-two, who was admitted to the New York Hospital, December, 1925, on account of a small swelling in the middle of the left thigh, accompanied by stiffness in the left leg and swelling in the left leg, which increased and became quite troublesome during her work. This condition she had first noticed four years previously and during that time she thinks the swelling has grown very slowly, has caused her no pain except the discomfort caused by the swelling of her leg after standing. The swelling of the leg has become more pronounced in the last two months and she thinks that the tumor in her thigh is also increasing in size.

Examination revealed over the middle aspect of the inside of her left thigh directly in the course of the femoral artery, a small irregularly-shaped mass, semi-solid in consistency, which is lifted up with each pulsation of the artery. There is no definite expansile pulsation. The tumor mass was not compressible and except on rather deep palpation was not tender. The entire left leg was swollen, the swelling being most marked between the tumor and the ankle, probably due to the fact that her shoe prevented the swelling of her foot. There were no palpable nodes in the left groin and her general examination was negative. The X-ray picture showed a mass of calcareous material in the soft parts well removed from the bone and in approximately the same region occupied by the tumor.

December 19, 1925, a four-inch incision was made along the inner aspect of the left thigh, exposing the tumor which lay directly on the femoral artery in the abductor longus fascia, where it begins to form the covering for the femoral artery. The tumor arose from the muscle tissue and had grown up around the artery so that the artery ran through a little groove in the base of the tumor and was compressed by it. The tumor was composed of a mass of venous tissue thoroughly encapsulated and with a number of calcified areas in it. The tumor was removed as a whole, dissecting it from the artery. The venæ comites were distinctly compressed, and after the removal of the tumor dilated. The saphenous nerve was also incorporated in the tumor mass and was dissected out without difficulty.

The patient made an uneventful recovery and left the hospital in eight days. The swelling in her leg had, when she left the hospital, entirely disappeared. There is still some disturbance in sensation in the distribution of the saphenous nerve.

Pathological report. Cavernous angioma with atypical proliferations of endothelial cells. Specimen consists of a small tumor-like mass of tissue $3\frac{1}{2} \times 3$ cm. The specimen was removed from the femoral artery and on

CAVERNOMA OF THE THIGH

one surface on the mass there is a groove through which the artery ran. Cutting the mass open shows it to be cystic in structure, the cyst having thick walls with deposits of calcium in them. The cyst cavity is practically filled with a fatty substance. A small amount of bloody fluid also was in the cyst. The cyst walls appear to be made up of muscle and fibrous connective tissue. Microscopic examination reveals an area of dense fibrous tissue with many dilated blood channels. At the edge of some of these sinuses there is a mass of neurotic and calcific material. Another portion consists of very cellular areas apparently at the edge of a hyalinized vessel wall. These cellular areas are composed of spindle and rounded cells, closely packed together, bearing some relation to rather definite small spaces containing what appears to be necrotic material. Their location suggests an endothelial origin. Scattered through this cellular mass are small hyaline structures, the exact nature of which cannot be accurately determined. They may be areas of hyaline connective tissue, or possible muscle fibres. The encapsulation of this mass appears to justify the assumption that the process, although very cellular, is relatively benign.

Post-operative diagnosis. Cavernoma of the abductor longus muscle.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting Held January 4, 1926

The President, DR EDWARD B HODGE, in the Chair

BILATERAL CHARCOT'S JOINT DISEASE OF THE ELBOW

DR CHARLES F MITCHELL and DR WALTER ESTELL LEE presented a man, forty-four years of age, who was admitted to the Pennsylvania Hospital, December 10, 1925, complaining of swelling of both elbow-joints. His history is somewhat inaccurate but apparently during the summer of 1924, he was suddenly aware of chilly sensations and fever which were associated with pains in both elbow-joints. He says that these joints began to swell and in a short time were three times their normal size. They were red and very painful. The pain, however, was not limited to these joints but involved other portions of the body for a short time. With the disappearance of the general pain the swelling of the joints remained the same and ten days after this acute onset he says that the left joint opened spontaneously, although he also made the statement that it had been incised by a physician. The latter statement seems the most probable. A very few days after the left joint opened the same thing occurred on the right side. Since the opening of these joints and their more or less constant drainage the pains have subsided. The deformities which now exist have gradually developed.

He had a chancre, and gonorrhœa in 1907.

An X-ray picture taken December 16, 1925, shows typical Charcot's disease of both elbow-joints. The blood Wassermann reaction, taken December 18, 1925, was negative. A spinal fluid Wassermann reaction, December 20, 1925, was positive. A colloidal gold test of the spinal fluid gave a characteristic curve of tabes. Neurological examination showed the man to have all the classical signs of tabes.

The reporter added that although Charcot's neuropathic arthropathy may affect any joint in the body, it shows a strong predilection for the joints of the lower extremities, and the elbow is one of the rarer sites of the disease. In addition to this, it is exceedingly unusual for the disease to be bilateral. In fact, a rather cursory survey of the literature reveals but two examples, both affecting the hip-joints, the first, a patient from the United States Naval Hospital, League Island, reported by Doctor DaCosta (*DaCosta's Surgery*, 9th Edition, p 605), the second, a case presented to the College of Physicians of Philadelphia in April, 1925, by Dr Walter Elmer (*Transactions of Philadelphia College of Physicians*, 1925).

The incidence of Charcot's disease is mentioned in but few text-books. Ochsner, quoted by DaCosta in his text-book of surgery (9th edition, p 604), states, "Of 947 cases the knee was affected in 394 (41.6 per cent), the hip in 210 (22.1 per cent), the shoulder in 128 (13.5 per cent), the foot in 89 (9.4 per cent), the ankle in 50 (5.2 per cent), the elbow in 39 (4.1 per cent), the hand 16 (1.7 per cent), jaw 2 (0.2 per cent), miscellaneous 19 (2 per cent)." Lovett (*Keen's Surgery*, vol 11, p 35) states that the lesion occurs in 5 to 10 per cent of tabetics and in a series of 268 cases affected the

CARCINOMA IN ADOLESCENTS

lower extremities 207 times (77 per cent) He gives the elbow as among the more unusual sites

On account of the combination of two rare conditions in this patient—namely, a bilateral Charcot's disease of the elbow, it was thought justifiable to present it before this society

DR B F BUZBY said that he had under his care at the present time a patient with a double, but not symmetrical Charcot joint A woman with Charcot joint of the foot and all the classical signs of tabes came under his care two years ago and was put immediately under anti-tabetic and anti-syphilitic treatment and given a brace for her foot and in the course of this treatment developed a Charcot knee on the opposite side which has progressed in spite of treatment The advance of the foot condition has been stopped, however, at least temporarily

CARCINOMA IN ADOLESCENTS

DR CALVIN M SMYTH, JR, presented a man, aged twenty-three years, who was admitted to the Methodist Hospital, November 4, 1924, in the service of Dr Damon Pfeiffer His chief complaint was vomiting, which he attributed to dietary indiscretion At the time of admission his bowels had not moved for four days He had no pain at any time prior to his admission The previous medical history was essentially negative, except for the fact that he had always been more or less constipated Examination showed a fairly well-nourished man of twenty-three He was having violent hiccoughs and vomiting small amounts of brownish material at half-hour intervals The heart, lungs, reflexes, etc, were all negative The abdomen was distended and tympanitic There was slight rigidity over the left rectus, no masses could be palpated Peristalsis was very active A rectal examination revealed a mass rather high, presenting into the pelvis from above Proctoscopic examination showed a mass which was thought to be extra-rectal, but which seemed to be discharging into the rectum The discharge was bloody in character An X-ray examination disclosed an obstruction above the rectum with considerable dilatation of the rectum The blood count showed no increase in the white blood-cells, the red cells and hæmoglobin were quite normal, and the blood Wassermann was negative

November 10, the abdomen was opened through a right rectus incision A mass about two inches in diameter could be palpated in the sigmoid about three inches above the recto-sigmoid junction, but could not be brought up into the wound The sigmoid and descending colon were therefore mobilized by incising the lateral leaf of the mesentery and stripping through the midline The right leaf of the mesentery was then cut along about one inch from the margin of the bowel and the sigmoid with its mesentery lifted from the hollow of the pelvis This still gave insufficient mobilization for a Mikulicz operation, and the operation having progressed to this stage, it was determined to amputate the bowel below the growth This was done, the bowel being divided between Payr clamps The rectal stump was invaginated by a purse-string suture of linen thread The proximal bowel was dissected upwards, clamping the mesentery close to the attachment to the bowel until about eighteen inches of the gut had been detached, with its mesentery The denuded area in the pelvis was covered in by suture and a cigarette drain placed in the hollow of the sacrum The upper portion of the bowel was drawn through a two-inch incision in the left rectus and fixed to the perito-

neum and to the abdominal wall. The bowel was then amputated with the cautery, two inches from the abdominal wall, and a Paul tube placed in the end. There was no immediate escape of gas or feces.

The post-operative convalescence was most stormy. The hiccoughing very violent, the vomiting continued and the bowel did not drain well. November 12, two days after the operation, jejunostomy was performed, under local anæsthesia. This was followed by a violent reaction during which the temperature rose to 104.3, the pulse to 160, and the respirations to 45, but after a very trying week or ten days, he began to improve, and January 7, 1925, he was discharged from the hospital, equipped with a colostomy bag, and feeling very well. The pathologist's report of the mass removed was adenocarcinoma.

The man exhibited did not present the general appearance of one who had any metastases. He had gained weight and was able to attend to his usual duties. He discarded his colostomy bag about three months after leaving the hospital, and got along very well without it. He was able to attend to his colostomy himself, and by taking an enema the first thing in the morning he was able to go without any protection during the rest of the day. This illustrated the fact that colostomy life was not the living death that we have been led to believe in the past.

DOCTOR SMYTH presented also a man, likewise aged twenty-three years, who was seen for the first time March 30, 1925. At that time he was complaining of "indigestion." His first symptoms appeared about three years ago, and consisted of a feeling of fullness in the epigastrium, heartburn and constipation. Under the use of antacids and carminatives his symptoms gradually grew less and he enjoyed a period of comparative health until one year ago. His symptoms then returned. When seen by the reporter he was complaining of pain in the epigastrium which came on one to two hours after taking food. The pain was not relieved by alkalies, but was sometimes relieved by food. He was vomiting about once every two days, but had never vomited blood. He had lost about ten pounds in weight. The abdomen was not distended, but there was tenderness in the epigastrium, and slight rigidity. He had had tuberculous hip disease in childhood from which he had apparently made a good recovery. He had been operated upon for suppurating cervical adenitis five years ago the scar of his incision being well healed and no evidence of recurrence being present. He was operated upon at the Methodist Hospital, June 1, 1925. The abdomen was opened through a right rectus incision. The peritoneal cavity contained a large amount of free fluid, blood-tinged in character. The stomach was drawn into the wound with some difficulty. There was a mass in the pyloric region about two inches in diameter, and about four inches long, very hard and nodular, and almost completely obstructing the pylorus. There was a stellate scar to the gastric side of the mass, which looked like a healed ulcer. There were many adhesions about the duodenum. The small intestine was studded with small hard nodules and the pyloric and mesenteric glands were all enlarged and quite hard. The large intestine showed a similar involvement, although the liver was apparently free from metastasis. A palliative posterior gastro-enterostomy was done, and one of the glands removed for microscopic examination. The pathological examination confirmed the diagnosis of carcinoma. Apart from a little post-operative vomiting, which ceased after two gastric lavages, the patient made an uneventful surgical recovery. He was able to eat, had no pain, and was discharged from the hospital July 15. He died at his home, August 16, having been able to eat to within two days of his death, and at no time having had any pain.

STRANGULATED INGUINAL HERNIA IN AN INFANT

This case is reported on account of the youth of the patient, the history and laboratory findings pointing to ulcer, and the operative confirmation of the existence of a healed ulcer

DR DAMON B PRILIFFER reported having seen a case of carcinoma of the rectum at the age of sixteen. When he was confronted with the growth, it was impossible to resect and do an immediate anastomosis, for after mobilizing he was unable to bring it up far enough without undue tension on the distal end. He therefore cut the bowel just above the pelvic floor and turned in the lower end. He then made the colostomy and cut off the excess of associated mesentery. The growth was reported to be adenocarcinoma. No glands were involved.

DR JOHN H JOPSON reported a case of carcinoma of the recto-sigmoid in a girl of twenty-five years, which he removed six months ago in two stages by the Jones technic. To-day she is in good health and able to earn a livelihood.

STRANGULATED INGUINAL HERNIA IN AN INFANT

DR BASIL R BELTRAN reported the history of a male infant, nineteen days old, who was admitted to the Misericordia Hospital, September 8, 1925. The child was well developed, weighing 9 pounds 12 ounces at birth and presenting no apparent abnormalities.

On the morning of its seventeenth day after birth the mother noted that he was rather reluctant to taking of food. Several times the milk regurgitated. Frequency and quantity of defecation lessened. No bowel movement or micturition was observed the afternoon of the eighteenth day. When seen shortly after admission the infant appeared greatly toxic. There was a marked restlessness accompanied by greenish vomitus, marked abdominal distention and a scrotal swelling about the size of a large English walnut (5 cm.). The mass was bluish, doughy and well circumscribed, the upper margin ending abruptly at the inguinal ring. No attempt was made to perform taxis, but immediate operation was done.

An incision over the left scrotal and inguinal regions was made under local infiltration anaesthesia (novocaine 0.5 and adrenalin 0.25). As the peritoneal structures were cut through, the tense congested gut was distinctly visualized. With great difficulty the fibrous external inguinal ring was incised. Immediately the scrotal peritoneum tore through due to the distended small intestine. Then owing to the infant's constant straining about 7 cm. of normal gut escaped through the opening. The sac contained about 5 cm. of livid small intestine. The glistening of the surface was faintly apparent. Following the application of warm compresses, evidence of returning circulation became marked. Repeated efforts to now reduce the intestines were futile, so for a few minutes which included tying of the peritoneal sac and reduction of intestines, ether was administered. Owing to the great amount of surrounding oedema and delicateness of the tissues it was with difficulty that a successful attempt was made to partially close the canal with chromic gut No. 0. The time of the operation, including infiltration, was thirty-five minutes. Though the pulse was imperceptible and respiration exceedingly rapid the infant was but slightly cyanotic on leaving the table. The following morning, five hours and again seven hours after operation the infant had copious bowel movements of dark brown fluid. Defecation then progressed at irregular intervals allowing the child to return to normalcy. The mother was allowed to nurse the babe eighteen hours after operation. The wound

CYST OF PANCREAS

tion of gastro-intestinal tract did not reveal the site of the lesion. Finally an exploratory laparotomy was done for a suspected carcinoma of the colon. The lesion was found at the duodeno-jejunal angle. It was a tumor of a probable inflammatory nature in consequence of a jejunal ulcer. A duodeno-jejunostomy was done with good immediate effect. The occult hemorrhages stopped for several months. The subsequent course of the disease, however, was unfavorable. The lesion was probably a carcinoma, for she died very cachectic about one year after the operation.

The second patient suffered from a carcinoma of the pancreas which had invaded the retroperitoneal tissue and caused an obstruction at the duodeno-jejunal angle. A duodeno-jejunostomy was done. The patient who was in very poor condition did not rally from the operation and died two days after the operation. In obstruction of the duodenum at the duodeno-jejunal junction, duodeno-jejunostomy should be done instead of a gastro-enterostomy.

DOCTOR GIBSON, in closing the discussion said that in these cases the obstruction could not be described as at the duodeno-jejunal angle. There exists a difference of opinion in regard to the proper operation to be performed, but he has not found the results of duodeno-jejunostomy to be so brilliant as they are described. He realized perfectly that gastro-enterostomy was not the logical operation in these cases, but the fact remains that they have been relieved of their symptoms after suffering very acutely.

CYST OF PANCREAS

DR JOHN M. HANFORD presented a man, aged thirty years, who was admitted to the Presbyterian Hospital, March 7, 1924, with the following history partly obtained by a letter from a surgeon who had previously operated upon him.

December 21, 1923, he was injured in an automobile accident and was taken to a nearby hospital. He was unconscious for the first twenty-four hours. He then began to vomit. Vomiting continued, together with pain in the upper abdomen, and then subsided, but recurred. There were evidences of fluid in the abdomen. He was operated upon about five days after the injury. The findings of this operation are reported to have been: Free blood in the peritoneal cavity, an adhesion of the transverse colon to the pylorus, and bleeding from the pyloric vein upon separating this adhesion. This is thought to have been the source of the bleeding. A small tear in the spleen was suspected, but on account of his poor condition it was not explored.

During convalescence from this first operation he again started vomiting, and it was thought that he had distention of the stomach without general abdominal distention.

On entering the Presbyterian Hospital he said that he had had vague discomfort in the left upper quadrant and slight prominence of the abdomen since leaving the former hospital. A week before admission to the Presbyterian Hospital he had had severe pains in the left upper quadrant during and following the taking of food, enlargement of his abdomen began to increase rapidly, and on the day of admission he vomited a little green fluid. He complained of numbness in the right upper limb since the injury.

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healed by primary intention. Convalescence was rapid. No complications ensued. The patient left hospital twelve days after admission. In this case the strangulation lasted thirty-six hours or more.

The youngest case on record operated upon for strangulated hernia with recovery appears to be that of Woodbury's in 1874. The infant was forty-five hours old when operation became imperative. Collins,³ in his paper in 1913 on the subject of hernia in infants, has covered the literature most thoroughly up to that time. After reporting his case of eighteen days he mentions various domestic and foreign observers as having reported cases eleven days to six months old, that were operated upon for strangulation with recovery. Our present remarks are confined to cases not more than one month old.

A Ceballos,¹ in 1912, reports a child operated upon when eighteen days old. G. Brown,² in 1913, one, one month old. E. C. Hall,⁶ in 1913, one, twenty-one days old. W. E. Lee,⁷ in 1914, one, twenty days old. A. A. Matthews,⁸ in 1914, one, thirteen days old. I. M. Guillaume,⁵ in 1915, one, fifteen days old. J. E. Fuld,⁴ in 1919, one, fourteen days old.

There may have been others recorded, if so, they have escaped the author's attention. Monihan's tables quoted by Cairnichael show strangulation to be the most common during the first month of life and gradually less frequent up to one year. Strangulated inguinal hernia in very early infancy while rare is not rare enough to be disregarded as a possible entity in the etiology of conditions occurring at that period.

The symptomatology of strangulated hernia in babies differs greatly from that of adults, due to the lack of subjective signs and the greater tendency to collapse. Objectively are to be noted marked restlessness and crying, recurrent vomiting (often fecal in character), constipation accompanied by abdominal rigidity and distention, and a tendency to retention of urine. Locally a swelling is present that may be either hard or soft.

With an accurate history and the persistency of the above signs showing a tendency to rapid collapse, the diagnosis is made. However, there are a few stumbling blocks along the diagnostic way, the more common being an ectopic testicle, a hydrocele and inguinal adenitis. Hydrocele may be eliminated by the serious aspect of the rapidly increasing symptoms in strangulation. Transillumination should never be considered, for hernia in early infancy may be translucent. Inguinal adenitis if unilateral is nearly always a secondary condition, due to abrasions or contusions on the side involved. If bilateral then the child may be the victim of general adenopathy the result of heredity.

Delayed intervention is unquestionably responsible for the fatalities. The recoveries in a great many instances are due to the marked recuperative tendencies of infants, but this quality should not suggest procrastination.

In the treatment too much emphasis cannot be laid upon the avoidance of prolonged or vigorous taxis. In the presence of strangulation operation is demanded. As far as possible, as in the case reported, a local anæsthetic should be used. If the intra-abdominal tension should become so great as to prevent intestinal reduction, then let a general anæsthetic be given so as to allow reduction and closure of the sac. The operation is continued under local infiltration. As to the manner of suture, the simplest method, consistent with the severity of existing conditions should be used. To transplant the cord is unnecessary. Simple suture of the soft parts and closure without drainage is all that is desired. Care is especially taken to prevent inversion of the incised skin edges.

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DR JOHN H JOPSON stated that he assisted the late Doctor Wharton to operate on a child about fourteen days old. He himself had operated in two or three cases a month old.

RETROPERITONEAL TUBERCULOUS LYMPHADENITIS

DR ISIDOR S RAVDIN read a paper with the above title.

DR DE FOREST P WILLARD said that a certain number of these cases of retroperitoneal tuberculosis come under the attention of the orthopaedic surgeon and give a little different symptoms than those described. In these children the symptoms strongly simulate Pott's disease of the lumbar vertebra. In these cases psoas abscess symptoms are the ones which usually predominate, they usually have backache, dull pain, a certain amount in spine, but with a distinct mass in psoas region. In several cases which have been followed closely they have shown no sign of spinal tuberculosis. Under the treatment of rest, physical therapy and so on, these cases have reabsorbed the abscesses and have cleared up. One case in which abscess occurred, became so large that fearing rupture it was opened. At that time the abscess was unquestionably a tubercular one, there was no sign of a bony involvement, tissue taken from the depth of the abscess mass revealed under the microscope some broken-down lymph tissue, so they felt the diagnosis of lymphadenitis was correct. It very closely simulates spinal tuberculosis and the ordinary psoas abscess of Pott's disease.

PSEUDO-PANCREATIC CYST FOLLOWING CHOLECYSTITIS

DR HENRY P BROWN, JR, gave the history of a man of thirty-seven years, who was admitted in Dr John H Jopson's service at the Presbyterian Hospital, November 23, 1923, complaining of pain in his upper abdomen. He stated that four days previous he was awakened with severe cramp-like pain in his abdomen which was generalized in character. He took magnesium citrate and castor oil and the purgation which followed afforded him some relief. At this time he induced vomiting. Subsequent doses of oil and attempts to vomit did not improve his comfort and on the day of admission to the hospital he had been vomiting continuously and had constant abdominal pain with acute exacerbations which he described as being "knife-like". From his description the vomiting had been projectile in character but not fecal. He had been belching gas but had not passed anything by bowel for twenty-four hours, in spite of five enemas and eight drinks of whisky. He said that he had had a similar attack one year ago which lasted one day. There were no urinary symptoms and nothing in the history suggestive of gastric ulcer.

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Physical examination showed a very obese man apparently suffering acute pain. The head, neck and chest with their contents were essentially normal, the abdomen somewhat distended throughout and slight tenderness in the mid-epigastrium. There was no tenderness or rigidity over the appendiceal or gall-bladder regions and peristalsis was not heard, probably due to the thickness of his abdominal wall. The admitting resident physician made tentative diagnosis of acute intestinal obstruction, acute pancreatitis or acute cholecystitis. The patient was placed in the Fowler position and given sodium bicarbonate and glucose by bowel.

The temperature, pulse and respiration were 98.2—76 and 22. Urine showed specific gravity of 1.036 with a trace of albumin, no sugar, a few hyaline casts and mucus. The blood examination showed 4,860,000 red blood-cells, 11,000 leucocytes and 96 per cent hæmoglobin. The blood Wassermann was negative.

Three days after admission his pain had disappeared, his sclerae were bile-tinged and his temperature, pulse, and respiration were 100.4—108 and 24. Four days later, the jaundice having disappeared and his urine being clear, his leucocyte count being 9000, he was operated upon by Doctor Pfeiffer, using nitrous oxide-oxygen-ether anaesthesia.

The peritoneum was opened through a mid-right rectus incision and the appendix delivered. It was apparently normal and was removed. Examination of the gall-bladder showed it to be so much inflamed that it was deemed best to remove it. This was a rather difficult procedure on account of the depth of the patient's abdomen. The cystic duct was isolated and ligated and the gall-bladder stripped out of its bed in the liver, the raw surface of the latter being covered with catgut sutures. A cigarette drain and rubber tube were inserted for drainage and the wound closed in layers. No mention is made in the operative notes as to the condition of the pancreas. The patient left the table in good condition, the duration of the operation having been one hour and forty minutes.

The drains were both out on the seventh day and the sutures were removed on the eleventh. On the following day the wound opened down to the fascia throughout its entire extent and Dakinization was started. At this time he also had projectile vomiting and ejected a considerable amount of gas.

On the fifteenth post-operative day he began to drain bile freely from the wound, the vomiting was less and he was more comfortable, his temperature varying from normal to 101°. He was discharged January 19 in good condition, wearing an abdominal belt.

The laboratory reported chronic diffuse appendicitis and chronic diffuse and suppurative cholecystitis. The gall-bladder showed the lumen entirely filled with cusped or faceted stones, varying from minute to about 7.5 mm diameter. The entire mucosa was a mass of acute inflammation and cross-section of the wall showed a moderate degree of inflammatory action.

He was readmitted to the hospital fifteen days later, sixty-six days after his cholecystectomy, complaining of a tumor in his upper abdomen, and sent to Doctor Allen's service, to whom the reporter is indebted for the privilege of operating upon and reporting this case. He stated that during his convalescence he had noticed an increase in the size of his abdomen, especially of the upper part. This had been gradual in character and thus far had caused no discomfort whatsoever. His appetite was good, his bowels regular, and he had no gastric, cardio-pulmonary or renal symptoms. The temperature, pulse and respirations were normal. The urine showed a few hyaline casts and a very faint trace of albumin and the blood count was 1,000,000 red blood-cells, 3,580,000, leucocytes, 10,200, hæmoglobin, 70 per cent, polymorphonuclears,

86 per cent , large lymphocytes, 10 per cent , small lymphocytes, 14 per cent. A diagnosis of cyst of the upper abdomen was made and he was operated upon eight days later

The previous operative scar was sterilized with iodine and covered with a rubber dam, bound down with adhesive. The peritoneum was exposed by means of a high left rectus incision and upon opening it the lower border of the stomach and gastro-colic omentum appeared in the wound. There was a large cyst of the upper abdomen and this was tapped by means of a trochar and canula thrust through the gastro-colic omentum, the fluid being allowed to escape quite slowly. Five quarts of straw-colored fluid were removed from the cyst and the incision then enlarged sufficiently to admit the hand. A handful of pasty brownish necrotic material was removed from the bottom of the cyst. The cyst wall was then marsupialized to the abdominal wall. A large drainage tube was inserted and the abdomen closed in layers. He left the operating room in good condition and made an uneventful recovery.

The drainage was profuse for twelve days, at the end of which time the notes state that there is practically no fluid aspirated from the cyst, it is nearly closed, and the drainage tube is inserted with difficulty. The discharge caused excoriation of the skin, so that it was necessary to use boric acid strips and zinc oxide to protect it. The incision became slightly infected, but soon cleared up under treatment, and he was discharged to the Surgical Dispensary for dressings on the thirty-third day after operation.

The diagnosis was hemorrhagic pseudo-cyst of the pancreas.

The fluid removed from the cyst showed a sterile culture. 15 per cent albumen and many red blood corpuscles. Later examination, sixteen days after operation, showed no lipase, trypsin or amylase. *Staphylococcus aureus* and *B. coli* were present. Smear showed 85 per cent polymorphonuclears and 15 per cent lymphocytes. The blood sugar was 93 mgm per 100 c c of blood.

Microscopic examination of tissue removed at the time of operation showed fatty and connective tissue necrotic throughout with areas of fat necrosis and diffuse hemorrhage.

When seen October 24, 1925, both of the abdominal incisions were entirely healed, there was no evidence of recurrence of the cyst, he said that he was in splendid health, and regarded himself as entirely cured.

The reporter added that in reviewing the recent literature on pancreatic cyst following acute infections of the gall-bladder he had found only one case similar to the above. This was reported by Ballin and Saltzstein in the *Journal of the American Medical Association*, vol lxxvi, No 22, page 1484. This was a man of forty-six years who had had several acute attacks of upper abdominal pain. At operation a gangrenous gall-bladder filled with stones was removed. Pain recurred shortly after leaving the hospital and he was re-operated upon two and one-half months after the first operation. At that time a pancreatic cyst was found from which four quarts of brownish fluid were removed. Amylase was present and active and trypsin was present but weak.

In discussing this case they bring out the fact that stasis and infection are closely related in disease of the gall-bladder and associated pancreatitis. Nordman, quoted by the above authors, showed that in dogs when the papilla of Vater was closed by a ligature thus allowing bile to flow into the pancreas, he could not produce pancreatitis. If bacteria were then injected into the gall-bladder pancreatitis was produced, though the injection of bacteria without ligating the pancreatic duct produced no result.

The case reported by Ballin and Saltzstein and the one here recorded have apparently the same underlying pathology, namely: 1. Acute cholecystitis and

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cholelithiasis with severe concomitant pancreatitis 2 Cholecystectomy followed by some interference with the biliary flow 3 Recurrence and accentuation of pancreatic inflammation with breaking down of pancreatic tissue followed by leakage of pancreatic secretions and bile into the lesser peritoneal cavity forming a cyst

DR DAMON B. FREIFER said that he recalled this case distinctly because of the operative complications. He was sure that he examined the pancreas at the time of the cholecystectomy, and was unable to note any particular abnormalities. Certainly he had no cyst there, or fat necrosis, or any of the recognizable evidences of pancreatitis. The diagnosis of pancreatitis was considered even before operation, but he was unable to verify this. Rupture of the wound followed the unwise removal of through-and-through sutures in a corpulent man, who was considerably distended, the wound breaking down all the way to bowel. He had a pretty desperate condition of affairs for some time. Though he had this extensive suppuration of his abdominal wall, he has absolutely no hernia.

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DERMOID CYSTS OF THE MEDIASTINUM

BY HOWARD L. BEYE, M.D.

OF IOWA CITY, IOWA

FROM THE DEPARTMENT OF SURGERY, COLLEGE OF MEDICINE, UNIVERSITY OF IOWA

DERMOID cysts of the mediastinum are rare tumors, only 118 having been reported. They are, however, a group of intrathoracic tumors which may frequently be amenable to surgical treatment. For this reason it is desirable that an understanding of the life history and clinical aspects of these tumors should become general so that they may be given due consideration in the differential diagnosis of chest conditions.

CASE REPORT—Male, schoolboy, age twenty. Entered University Hospital, July 11, 1922.

History—Four years ago had an attack of pleurisy with effusion in the left side which subsided completely in one month. Two years later began to have stabbing pains on the same side which increased in the severity and duration of attacks over a period of several weeks. Immediately following an unusually severe attack which "doubled him up," he was operated upon for empyema, by rib resection. The discharge was thick, profuse and yellow. It gradually lessened in amount and became more serous in character, of a sour odor and irritating to the skin. A sinus has persisted following the operation. Ever since the onset two years ago, the patient has had occasional chills and an irregular fever which has reached 103. Cough has been a fairly persistent symptom. It often produces aropy, yellow sputum, small in amount and not foul. Has never spat up blood. Following drainage of the chest, the cavity was irrigated for several months until on one occasion the patient had a severe attack of coughing and choking, and tasted the irrigating fluid. There has been a loss of thirty-four pounds in weight and 50 per cent of strength.

Past Medical History—Negative except for the ordinary diseases of childhood and tonsillectomy eight years ago.

Examination—The general examination was negative except for the chest. The latter was somewhat flattened in the upper half on the left side. A sinus was present in the left anterior axillary line over the seventh rib, from which discharged a greenish-yellow pus. The skin was reddened and tender. Dulness was present over the lower half of the chest in front and back and the breath sounds were very distant. No rales were heard. The right side was normal. The right border of heart dulness was undisturbed.

Laboratory Findings—There was no leucocytosis, the von Pirquet and Wassermann tests were negative. A roentgenogram of the chest showed a dense shadow in the left from the fourth rib to the diaphragm. The upper border of this shadow was well outlined and slightly convex upward.

A diagnosis of chronic empyema was made.

Operation—July 17, 1922. Nitrous oxide anesthesia.

Three inches of the seventh rib was resected in the region of the sinus. The underlying pleura was very thick and tough. Upon incising it, some white, gummy material escaped from the cavity and was taken to be bismuth paste although nothing in the history

suggested that this material had been injected into the cavity. Several fine hairs were then seen to protrude through the opening. These led to the diagnosis of dermoid cyst.

The incision was enlarged and four inches of the sixth rib removed and the intercostal muscle between it and the seventh divided, together with the tough pleura. This exposed a cavity which was the size and shape of a large grape fruit. It extended from the antero-lateral chest wall upward, inward and mesially. No bronchial communication was seen. In places the cavity was lined by irregular areas of epithelium which resembled skin. This tissue was thick and tough and from its surface projected firmly attached hairs an inch long. The follicle openings in this skin-like epithelium were readily seen.



FIG. 1.—Röntgenogram of chest before operation

The major portion of the wall of the cavity was lined by coarsely granular tissue which merged indefinitely with the epithelial tissue. It was purplish-red in color. The cavity was filled with pale yellow, homogeneous, cheesy material with fine light brown hair matted in it. The wall of the cavity was inelastic and moved very little during respiration. The pulsation of the heart against its mesial aspect produced definite excursion.

A complete decortication of the lining membrane of the cavity was technically impossible because of its great depth. The largest piece of epithelium, the size of a 50-cent piece, lay on the posterior wall and was removed by cutting. It did not strip off. Two smaller areas were also dissected away. The rest of the cavity wall was carefully curetted in an attempt to remove any remaining epithelial lining. The cavity was loosely packed with gauze and the incision partially closed.

No pleural irritation was manifested at any time.

Post-operative recovery was uneventful, the patient improved generally, gained 17 pounds in weight and left the hospital on the fifty-third day with a tube leading into the cavity. The latter had decreased somewhat in size.

Eleven months after his operation he returned because of a persistent sinus. He had continued to improve and was working daily on the farm. The cavity was still of large size but smaller than at the time of operation.

Operation—June 14, 1923. Ether anæsthesia.

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An incision was made to circumscribe the sinus. A vertical incision was made at right angles to it and segments of the fifth, fourth and third ribs removed.

A cavity was present the size of an orange which contained a few loose hairs. It was completely lined by white, wrinkled skin-like epithelium from which projected many fine grayish hairs. It had the appearance of skin upon which a hot moist dressing has been applied for several days. The wall of the cyst was nearly a centimetre thick, extremely tough and was tightly adherent to the adjacent pericardium, lung and diaphragm. It lay deeply in the angle between heart and lung. Dissection was made by cutting with scissors in the line of cleavage. Several large vessels passed into the cyst wall from the visceral pleura. It was possible to remove the entire cyst wall and the sinus tract leading into it *en masse*.

The resultant cavity was partially obliterated by a few sutures taken in the angle, between thickened pleura and pericardium. A gauze pack was then applied and the incision partially sutured.

Post-operative Course—Uneventful recovery after a week of high febrile reaction. The patient returned home on the nineteenth day and the wound was healed completely at the end of four months.

Examination April 6, 1925, or nearly two years after removal of the dermoid cyst, disclosed a well-healed scar (Figs 2 and 3), and no evidence of disease in the lung or pleura. He has entirely recovered and is working daily.



FIG 2—Site of operative approach is shown by scar. Photograph taken two years after operation.

Histological Report—Sections show a stratified squamous epithelium lining the cyst with all the elements of skin present, sweat glands, sebaceous glands and hair follicles. One part of the cyst is lined by a single layer of cuboidal epithelium. There are also traces of lymphoid tissue. In the wall of the cyst there are a few glands of uncharacteristic shape and appearance, these are lined by double layers of high columnar epithelium.

General Consideration—Mediastinal dermoids occur at all ages, but the great majority of cases are found in patients between the ages of fifteen and thirty. There is no sex preponderance. In an occasional case a blow on the chest or an infectious disease has apparently incited the tumor to activity.

Symptoms—Mediastinal dermoids present a symptom complex which is quite variable. The symptoms may be due to pressure of the enlarging mass upon the adjacent tissues or organs or may be due to irritation of the tumor producing the clinical picture of an intrathoracic inflammatory process.

The onset of symptoms is often insidious, extending over a period of months or years. Cough is the commonest initial symptom. It may be dry and hacking or productive of a glairy mucus or pus. Hemoptysis is not uncommon. This may be evidenced by blood-tinged sputum or it may be profuse and may lead to a fatal termination. Hair has been found in the

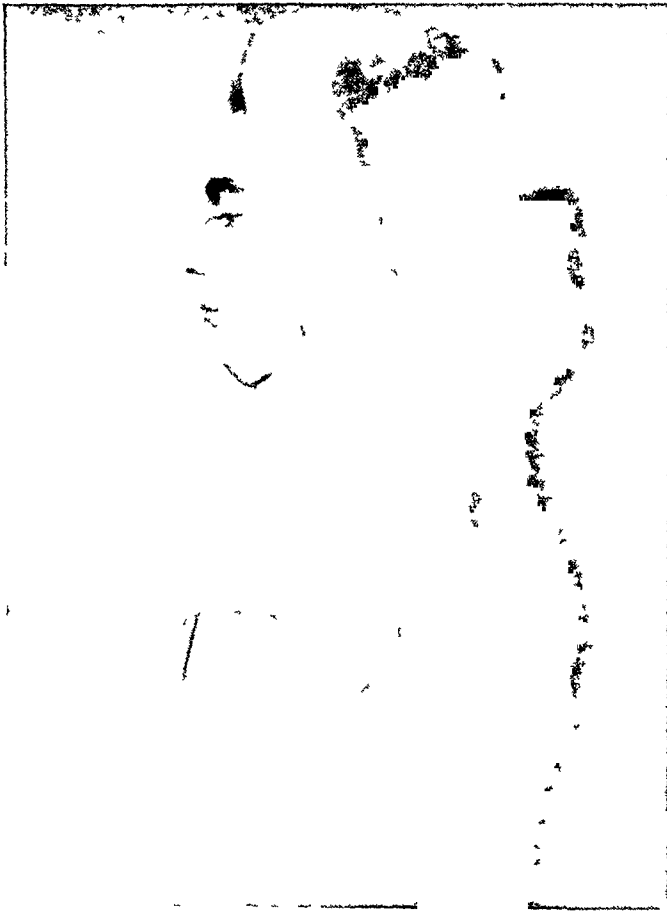


FIG 3—Site of operative approach is shown by scar. Photograph taken two years after operation.

sputum in several cases, and in others there has been raised a fatty, glycerin-like matter containing cholesterol crystals and also squamous epithelium.

Dyspnea is another common symptom, and may become extreme. Dysphagia may be present. Pain is sometimes the initial symptom or may occur later. It varies from an indefinite sense of substernal pressure to sharp and stabbing. It is usually referred to the location of the tumor.

The onset is less commonly acute, simulating pneumonia, empyema or pleurisy with effusion. The latter may develop and complicate the picture.

Sometimes the acute symptoms will subside to be followed by exacerbations of a chronic course.

Fever, loss in weight and strength, and anorexia are common symptoms and chills may occur.

A visible swelling may develop with or without other symptoms. This may appear above the sternum in the midline, behind the clavicle, or produce a diffuse bulging of the chest wall on the affected side. When it approaches the surface above sternum or clavicle, it may have the boggy consistency of a wen, or suggest a cold abscess. In a few of the cases, the swelling has pulsated, due to intimate relationship with underlying blood-vessels.

In a few of the reported cases, there were insignificant or no symptoms produced by the mediastinal tumor, the latter being an incidental finding at autopsy.

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The course may be very rapid or the symptoms may persist over a period of many years, but in a majority of the reported cases the patients succumbed in from one to four years after onset of symptoms unless successful treatment was instituted. In the unoperated cases death was commonly due to pulmonary hemorrhage, dyspnea, exhaustion or sepsis.

Diagnosis—A mediastinal dermoid should always be considered in a patient with the signs and symptoms of a mediastinal or pulmonary tumor, especially if the patient is between fifteen and thirty years of age and the growth of the tumor is slow.

The tumor is usually of considerable size and is commonly in the upper portion of the thorax and to one side. It may, however, rest upon the diaphragm.

If a tumefaction is produced above the sternum or clavicle, it may have a boggy consistency as of a wen, which is an important diagnostic point. Hertzler⁵ made a correct diagnosis of his case on this finding.

The finding of hair in the sputum has led to the diagnosis in several cases. Sputum containing a fatty or glycerine-like substance, or squamous epithelium is highly diagnostic.

Aspiration of the tumor may obtain hair and the diagnosis thus be positively established, as in Harris' case⁶. The finding of an oily yellow material containing cholesterol crystals or squamous cells would be strongly diagnostic. When, however, the presence of a dermoid is suspected, it is questionable if aspiration of the tumor is indicated. Thoracotomy would be a preferable procedure.

X-ray and fluoroscopic examination may show a well-outlined spherical shadow surrounded by normal lung, and with no expansile pulsation. Calcification of the wall of the tumor might be demonstrable in an exceptional case. The finding of tooth-like shadows in the shadow of the tumor itself would be significant. Typical X-ray findings would be greatly masked in cases with an effusion into the pleural cavity.

Differential diagnosis must include all cases of solitary intrathoracic tumors, aneurism, and pleural and pulmonary infections. Many of the cases were considered to be pulmonary tuberculosis based on the symptoms of cough, loss of weight and strength, fever and hæmoptysis. In this connection it should be noted that in a few cases there has been shown at autopsy an active pulmonary tuberculosis in addition to the dermoid. Pleurisy with effusion or empyema may be diagnosed and these conditions may also complicate the picture in the presence of a dermoid.

Pathology—The tumors are spherical in outline. In size they vary from that of a hen's egg to a mass which fills one side of the thorax. The position varies greatly. A majority lie in the upper half of the mediastinum anteriorly and just behind the sternum. Here the mass may extend upward to protrude in the suprasternal notch. The tumor may extend to one side or the other displacing the lung, and may appear behind or above the clavicle.

He was a poorly nourished, chronically ill appearing young man. There was marked bulging and prominence of the abdomen rather more to the left than the right and more in the upper than in the lower abdomen. There was a recent right rectus scar with three small granulating areas in it. There were no visible pulsations. Palpation revealed abdomen generally tense. A fluid wave was present. There was tympany in the right flank and in the right lower quadrant and dulness in the left flank and left upper quadrant with little change on change of position. The splenic dulness appeared increased, but neither spleen nor liver were felt. Succussion sound was obtained in the anterior upper part of the abdomen.

The temperature, pulse and respiration were normal. The blood count, urine and blood Wassermann were all normal. Plain X-rays of the abdomen in the supine and lateral positions showed "A shadow which might be due to a cyst or tumor in the upper abdomen."

The gastro-intestinal X-ray examination showed "The left diaphragm slightly elevated. A gas bubble not in contact with the diaphragm as it usually is. The stomach flattened against the anterior abdominal wall." The roentgenologist indicated that there might be something pushing the stomach forward from behind.

Operation March 15, 1921—On opening the peritoneal cavity the stomach presented and appeared normal except that it was low in position and rather flattened antero-posteriorly. There was no free fluid in the general peritoneal cavity. Exploration of the general cavity was difficult because of the extreme tenseness of the fluid in the lesser sac. On exploring further it was found that the lesser omentum was tense and bulging forward and fluctuated. An aspirating needle was inserted about 2 or 3 cm. above the lesser curvature of the stomach and watery turbid fluid was withdrawn. Through the needle puncture more fluid spurted out, so that a larger opening was made and a sucker inserted. There must have been about 5 litres of this fluid completely distending the whole lesser sac. The lining of the sac on thorough investigation appeared normal except for three things: (1) Obliteration of the foramen of Winslow. (2) A varicosity on the anterior surface of the left renal vein in front of the vertebra. (3) A 4 cm. tear in the peritoneal surface just behind the middle of the lesser curvature of the stomach.

On tracing with a probe into this tear no opening in the stomach wall could be detected. There was no evidence here of inflammation. It is possible that this tear may have overlaid the varicosity and that at the time of the injury both lesions were produced. The fluid was more like that of a transudate than of an inflammatory exudate. Yet it is hard to understand the obliteration of the foramen of Winslow. Adhesions between the great omentum, the right border of the lesser omentum and the anterior abdominal wall prevented exploration of the gall-bladder and the whole upper right side of the abdomen. The pancreas felt soft and normal but was displaced downward apparently by the tremendous distention of the lesser sac. The fluid from the lesser sac was all aspirated. Exploration further revealed the boundaries of the lesser sac to be those of a sacculated collection of fluid. The wound was closed, leaving a Penrose tube of a soft rubber dam drain in the lesser sac through the opening in the lesser omentum.

The pathologist reported that the bit of tissue removed from the lining of this sacculated cavity showed dense connective tissue with swollen collagen fibrils, and lining membrane apparently composed of atrophic connective-tissue cells and very little inflammatory reaction.

Less commonly the tumor is situated in the lower portion of the mediastinum, pushing its way into the pleural cavity between lung and pericardium, and resting upon the diaphragm. The whole pleural cavity may be practically filled with tumor.

Rarely the mass is found embedded in lung substance.

It is the relationship between these tumors and neighboring structures which is the chief concern in consideration of surgical treatment. The tumor is commonly in close contact with the large vessels in the upper mediastinum and often adherent to them. It may be more or less densely adherent also to lung, pericardium, sternum, chest wall or diaphragm. These adhesions to important structures and at great depth may make complete extirpation of the tumor impossible.

Erosion into the lung with establishment of a bronchial communication is fairly common. Further increase in growth of the tumor does not seem to be affected by the formation of a bronchial fistula. In one case the wall of the aorta was eroded and in another case the pericardium was entered by the tumor.

Effusion into the pleural cavity is not an uncommon complication and the cavity may become infected. Tuberculosis of the lung may be an associated condition.

Structure—In the simplest form the tumor is made up of a single cyst with a well-developed fibrous tissue capsule and lined by stratified epithelium with hair follicles and sweat and sebaceous glands. In this type, considerable relief may be obtained by simple drainage if total extirpation is not feasible.

The tumor may consist of multilocular cysts, independent, or communicating with one another, and polypoid growths may be found extending into the cysts. The structure may be fairly complex, with areas of cuboidal or columnar epithelium, bone plates and cartilage, or even teeth buried in the walls or lying in the cavities. Areas suggesting thymus or thyroid may be found. The content of these cysts consists of an oily liquid or a greasy salve-like material containing hair in various quantities.

Tumors have been reported which contained well-formed bone resembling a superior maxilla, elements of the intestinal tract, striated muscle and nervous tissue. Solid teratomata make up a small group of reported cases. Malignant degeneration, carcinomatous or sarcomatous, has occurred in a few cases, with or without metastasis.

Genesis—"A single origin through one-sided developments of teratomas cannot be excluded for the entire group. Yet most authors regard the simple tumors as derived from the third branchial arch which produces the deep sinus cervicalis and the thymus. The intimate relations of ectodermal and entodermal layers of the third and fourth arches may explain the variety of the epithelium and the connection with the thymus and thyroid, while the descent of the heart may carry these structures deep into the thorax. Der-

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moids of the lower mediastinum may result from imperfect closure of the anterior chest wall " (Ewing¹)

Treatment—Exploratory thoracotomy is indicated in any patient who is suffering from an intrathoracic condition, the diagnosis of which is obscure and in which a dermoid is a possibility

The ideal treatment is total extirpation. This may be impossible because of the situation of the tumor or because of the character of the adhesions which bind it to vital structures. Fortunately, however, even with the largest tumors which have produced marked symptoms of pressure, the attachments are frequently very loose and easily broken down.

Where the tumor is so large or so adherent or so situated that its removal is not practicable, drainage is indicated. This will accomplish most in the single cyst tumors. Drainage may be followed by a cure. In other cases, as in the one reported above, the tumor will become smaller and its removal may be attempted later with greater technical ease and with less danger to the patient.

In some of the cases drainage has been followed by a persistent sinus and in others the procedure has proven fatal. It is difficult to see how drainage will accomplish very much in the complex multilocular cysts, and in this group one would be justified in taking a greater risk in making the attempt at complete extirpation.

Following complete removal of a dermoid, a large cavity may remain which will be slow to become obliterated, due in large measure to the atelectatic condition of the compressed lung. Plastic procedures may prove necessary to obtain a cure.

Of the 119 reported cases (including the above case) 57 (47 per cent) have been operated upon by drainage or removal of the tumor. The following results were obtained in the 57 cases: Recovery, 22 (37 per cent), improved, 17 (30 per cent), not stated, 5 (10 per cent), died, 12 (22 per cent). These figures show that of the operated cases over two-thirds were cured or improved, and that, while the operative mortality of 22 per cent is high, the risk of operation is not out of proportion to the chance of relief which may be given in otherwise hopeless cases.

SUMMARY

Dermoid cysts of the mediastinum are rare tumors. Patients suffering from such tumors may be cured or relieved by operation.

These tumors may be diagnosed in some cases by positive signs or symptoms.

Mediastinal dermoids should be given due consideration in the diagnosis of all cases suggesting intra-thoracic new growths or obscure infections.

Exploratory thoracotomy is indicated when the diagnosis of a mediastinal dermoid is suspected.

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HEMIGLOSSECTOMY BY ENDOTHERMY IN CARCINOMA OF THE TONGUE

By GEORGE A. WYETH, M.D.
OF NEW YORK, N. Y.

It is difficult to overemphasize the importance of sound pathology to successful surgery, but not all of surgery's failures can be laid at the door of faulty pathology. Too often the weakness is in the operation itself, and surgeons, realizing this, are interested in the details of improved technic, even as many have accepted in the treatment of malignancy the various physical measures which promised either relief or cure without certain of the concomitants of operation by the scalpel.

Although little is known of the definite cause of cancer, enough is understood of the different forms in which the disease manifests itself and of its varying degrees of virulence (a variation well indicated in Broders' system of one to four gradation) to convince us that it should be discussed in particular. It is too large and too special a subject on which to generalize.

This paper seeks to direct attention, therefore, only to the progress being made in the treatment of malignancy in the oral cavity, to the advance shown in recent work in the destruction and removal of cancer of the tongue and floor of the mouth by endogenous heat. We know that buccal cancer has a tendency to metastasize early and tends after removal by the scalpel to recur in or near the original site as well as to develop a malignant recurrence along the line of the scalpel's incision.

For reasons which are not very clear, cancer lesions of the mouth are often not brought to the attention of the surgeon until practically inoperable by ordinary methods. Interesting figures on this subject have been collected by Simmons,¹ who reports that Bloodgood found in a series of cases of cancer of the mouth that 50 per cent had received poor advice from the first physician consulted. Farr,² of the New York Hospital, found that 66 per cent had received poor first advice.

Metastases and recurrences are in no other part of the body more menac-



FIG. 1.—Blood-vessels have been ligated on left side. Retraction suture inserted on sound side of tongue. Allis clamp grasps diseased side at tip. Tongue is drawn forward. Beginning at base of tongue well beyond lesion isolating line of coagulation is drawn.

¹ Simmons, C. C. Cancer of the Tongue and Mouth. Amer. Jour. Roentgenol. and Rad. Ther., N. Y., 1925, vol. XIII, p. 545.

² Farr, C. E. Delay in Treatment of Cancer. Am. J. M. Sc. Phila., 1925, vol. CLXIV, p. 712.

ing than in cases involving the mouth and buccal surfaces, one reason being that they here represent in addition to their own malignancy an interference with normal diet which the patient can ill sustain. In this region every need of the patient calls for immediate removal of the lesion in a single operation, and it is for this reason that the use of radium for cancer of the mouth and tongue is less generally recommended than was the case ten or even five years ago. The reaction from the employment of radium in mouth conditions being highly painful, and it being necessary to wait for many weeks for any accurate observation as to whether or not the malignancy has been destroyed,

the profession has felt that, in comparison, surgery with its promptness was much to be preferred.

Childe, of London, in "Cancer and the Public" (1925) says "Radiotherapy carries with it an obvious danger in that it is a far more attractive proposition and is naturally a much more tempting offer than a surgical operation ever can be. For people in the present state of our knowledge to try this treatment first in cases suitable for surgical removal



FIG 2.—Path of coagulation necrosis is continued down midline of tongue by thrusting needle through and through the tongue.

is tantamount to deliberately forfeiting always their best chance and frequently their only chance of cure."

In endothermy we have a refinement of surgery which adds to promptness of removal of the malignancy in a single operation, the advantage which inheres in its excision as dead tissue instead of as a mass of viable cells. By the technic of endothermy the malignant area is isolated by a line of protective necrosis drawn in healthy tissue surrounding the lesion. This line seals off the lymph channels and blood-vessels by which cancer cells are disseminated and severs and caps the sensory nerves. The malignancy is then attacked *in situ* and coagulated by the bipolar current, after which it is excised as a dead mass by the endotherm knife.

In a brilliantly informing article in *Minnesota Medicine* for January, 1925, on "The Relative Values of Surgery and Radiotherapy," W J Mayo says, "Modern operative procedures not only remove diseased tissue, but also the path by which the malignant cells reach locations beyond primary focus. Operation removes, in a block, the lymph-nodes adjacent to the growth."

We conceive this to be the purpose and high aim of surgery in malignancy but surely the metastases which often follow operations by the scalpel, and the frequent implantation of malignant cells along the line of the scalpel's incision are evidence enough that the ideal is not always realized.

Pointing out that only particles of molecular size, such as sugar, the amino-acids, and other crystalloids, are absorbed directly through the vascular

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capillaries of the body, while colloids and large particles are picked up by the lymphatics. Doctor Mayo says "Bacteria and malignant cells do not pass directly into the capillaries but are carried by phagocytes into the lymphatics which are a closed system of vessels"

Hence the danger of mechanical dissemination which lies in the scalpel's severance of these lymphatics from a malignant area, and the advantage to the operator and the patient inhering in the proper employment of endothermy

Clayton-Green, as reported in the *Proceedings of the Royal Society of Medicine*, 1921-22, says "It was my great dissatisfaction with the results obtained by the ordinary operative methods in carcinoma of the tongue, tonsil and floor of the mouth which led me to adopt diathermy" (bipolar endothermy) "as an alternative"

Cumberbatch of St Bartholomew's Hospital, London, reporting the successful use of electrothermic methods in cases of malignancy of the mouth, concludes that even if the final results of the method were no better than those given by cutting operations, the quickness of the new method, the absence of bleeding, the relief of pain, the rarity of complications, the absence of shock, and the very short stay in bed with little discomfort would render high frequency currents a formidable rival to the knife in the treatment of malignant disease. He finds, too, the soft, non-contracting scar which results from the electrothermic operation one of the great advantages

Writing in *The Lancet* for July 1, 1923, Davies-Colley says "I believe diathermy to be far the most hopeful treatment in all cases of carcinoma in the mouth whether they be amenable to complete excision or not, and I have

used this method entirely for the past eighteen months with much better results than I ever obtained with the knife alone"

Claude Sabeton wrote, in *The British Medical Journal* in 1921 "We operate upon all diseases of the tongue and floor of the mouth by the diathermic method, believing that any case operable by ordinary methods is much better treated by diathermy, and also that it is possible to remove successfully some growths otherwise inoperable. The removal of a malignant tongue by



FIG 3 —This isolating path of destruction seals lymphatics as it is produced and is carried to the tip of tongue coming out between retention suture and clamp



FIG 4 —Elevating tongue circumvallation is carried along under side of tongue including floor of the mouth if indicated

this method is quicker than by the use of scissors or scalpel and is a less formidable proceeding. Other advantages are a bloodless field of operation, diminished sepsis and septic absorption, and rapid convalescence. Since October, 1918 (approximately three years), we have operated on 12 cases of malignant disease of the tongue. Up to the time of writing no local recurrence of the disease has occurred in any of the cases.



FIG 5—Shows distinctly the white line of coagulation which has capped the sensory nerves and is continued to the starting point

Diathermic removal of a malignant tongue is followed by cessation of discharge, relief of pain and rapid improvement in the general health.

Comparing electrothermic methods with cutting operations, Steward, Surgeon to Guy's Hospital, reported in *The Practitioner* for May, 1922, "Long experience of operations for malignant disease of the mouth and throat has

taught me how serious a factor is the subsequent shock and how often it paves the way for sepsis which may result in secondary hemorrhage or septic pneumonia. I can appreciate to the full the value of diathermy in this regard, for in none of my cases has there been any serious degree of shock and all have recovered in a few hours from the immediate effects of the operation. In the first place it is a bloodless operation, or nearly so. In a few cases there is slight bleeding but this is usually easily arrested by the further application of the electrode to the bleeding spot. The advantage of this in simplifying the operation and diminishing the risk run

is obvious, for the operation can be carried out with precision in mouth and throat cases there is no fear that blood and septic material will reach the lungs, and the patient is necessarily better for the absence of the loss of blood. Further the freedom from loss of blood largely contributes towards what is undoubtedly the greatest advantage of diathermy over a cutting operation, namely the absence of shock and collapse."

It will be observed that in all these quoted extracts our British colleagues refer to surgical diathermy, the bipolar, coagulating current being the one introduced to their attention by Nagelschmidt in 1910. Nagelschmidt employed a blunt electrode and that type of applicator is still in general use among the operators who follow his technic. But although the general employment of high frequency



FIG 6—Specimen is now taken for the microscope with tissue gouge after which complete coagulation *in situ* of left side of tongue (and floor of the mouth if indicated) is begun

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currents in surgery in England and the Continent is practically limited to the bipolar current applied through a button electrode, enough has been quoted to show that our colleagues overseas are obtaining results in cancer surgery in advance of what is possible to operators who use the scalpel alone. Confirmation of their experience comes to us from Cile, whose conclusion, expressed in an article in the *New York State Medical Journal* for November 15, 1925, is "The most efficient method for destroying an early cancer of the tongue is electric coagulation or cauterization with the actual cautery. Radium would suffice to destroy the growth, but the radium burn is exceedingly painful." Kelly, developing endothermy in the removal of cancer of the breast, and in general accessible malignancy, writes in *The Medical Journal and Record*, July,

1925, "I welcome this new method (endothermy) as a great addition to our technic, not only enabling us to do some things better, but greatly enlarging our field of beneficent activity. I give the Wyeth sector the leading place and decided preference in my daily work, relegating the scalpel to a subordinate position." What is meant by correct endothermy technic is developed later. First we would say a word as to what endothermy is.



FIG 8—By one turn of a switch the cutting current (endotherm knife) is now brought into play. With the same needle an incision is begun slightly to left of midline at tip of tongue between retention suture and the clamp.



FIG 7—Coagulation is produced from midline outward to edge of tongue. Again going over the entire diseased half to assure thorough coagulation. Up to this point the bipolar current has been used exclusively, 1,000 to 1,500 milliamperes.

Endothermy is the surgical application of high frequency currents. It is the production of heat in the tissue from within (endogenous heat) in response to the many oscillations of a high frequency current, and the application of this heat to surgery.

Endothermy is not cauterization, for it does not burn. It is not fulguration nor diathermy. The term is a comprehensive one, including, as it does, all forms of the surgical application of high frequency currents, namely the production and use of the

monopolar current to cause desiccation of tissue, the production and use of the bipolar current to cause coagulation (surgical diathermy), the production and use of the cutting current by which is accomplished a molecular dissolution and a thin line of coagulation which seals lymphatics as it cuts.

Of the three currents provided in endothermy the first named, the monopolar, is the one most often employed. It is applicable to that long list of

lesions which are accessible and which have extent but only slight depth. The destruction accomplished by the monopolar current (like the other currents of endothermy) is entirely under the control of the operator who can so throttle down the current as to remove a growth from the conjunctiva

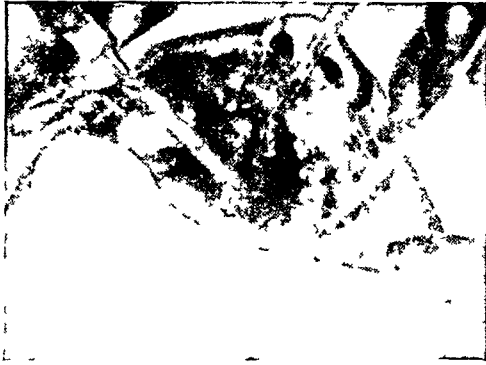


FIG 9 —With tongue elevated this incision is continued backward through the dead tissue of the tongue along under side until starting point is arrived at

without injury to the vitreous chamber, or, with equal precision, to dehydrate a small tumor of the vocal cord.

It is the monopolar current which is employed for the desiccation and removal of patches of leukoplakia, that so resistant condition which, being generally present in cases of malignancy of the oral cavity, has come to be considered a precancerous condition. Monopolar endothermy is efficacious in the removal also of those small cysts, ranulas, benign giant-cell

tumors (epulis), fibromas, papillomas and angiomas which offer such difficulties to excision by the scalpel.

Bipolar endothermy, the method using the deep-penetrating coagulating d'Aisonval current of comparatively low voltage and high amperage, offers a wide extension of high frequency usefulness in the treatment of accessible neoplastic diseases. There are many variations of application in bipolar endothermy, depending upon the character of the lesion to be destroyed and its location. Since the only effect of the current is the production of heat in the tissues from within (the effect is not electrolysis) the sharp-pointed electrode may be of any suitable metal, but it has been found that the range offered by steel sewing or darning needles is ample for our needs. If the coagulation is not to be extensive, and not on highly resistant tissue, a fine needle is used, if heavy destruction is desired, a heavy darning needle may be employed. This is held in an insulated handle (Wyeth).

Tissue treated by the coagulating current of bipolar endothermy undergoes a very different change from that experienced by tissue which has been dehydrated by the monopolar current.

The lighter current (Oudin) dries out the cell without destroying cell outline. To this change Clark has given the name desiccation. Asnis has called it mummification necrosis. Treated by the heavier current of bipolar endothermy the tissue loses all semblance of cell structure in coagulation.

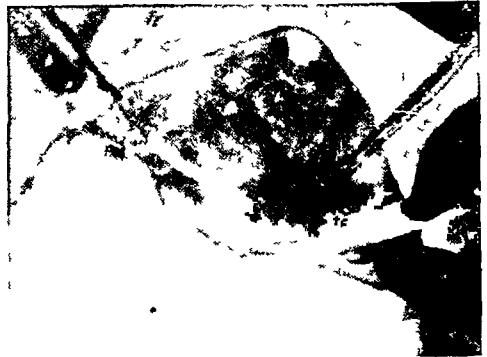


FIG 10 —Shows the epithelioma now being immediately removed by the Allis clamp as a necrotic mass instead of as a group of viable cells. If operation is properly done there should be no bleeding.

ENDOTHERMY IN CARCINOMA OF THE TONGUE

The third current of endothermy, the cutting current, of exceedingly high frequency, ruptures the cell structure, incises by molecular dissolution. The line of incision is marked on either side by a slight thickness of coagulation the advantages of which are understood when the importance of sealing lymphatics and capping nerve endings is considered.

Endothermy is technic as well as the application of current, and it is largely through the development of a procedure which combines effectively the bipolar and the cutting currents in the removal of malignancy of the buccal surfaces that endothermy's record has been made. Its application to the treatment of malignancy in the oral cavity will be developed in case reports to appear hereafter.

According to Broders³ "The most important factor in squamous-cell epithelioma seems to be the degree of cellular activity. The grading was made on a basis of 1 to 4 and absolutely independently of clinical history. If an epithelioma shows a marked tendency to differentiate, that is, if about three-fourths of its structure is differentiated epithelium and one-fourth undifferentiated, it is graded 1, if the differentiated and undifferentiated epithelium are about equal, it is graded 2, if the undifferentiated epithelium forms about three-fourths and the differentiated about one-fourth of the growth, it is graded 3, if there is no tendency of the cells to differentiate, it is graded 4. Of course the number of mitotic figures and the number of cells with single, large, deeply staining nucleoli (one-eyed cells) plays an important part in the grading." Elsewhere Broders states



FIG. 12—Three weeks after operation. Note how nature has already begun to restore lost tissue.

of an irregular nature, one is inclined to raise the grade to some extent."

It will be seen at once that in comparison with the definiteness of this classification the case records as kept generally in office and hospital work are inconclusive. Unless some such system of grading by degree of malignancy



FIG. 11—A clean dry wound. Retention suture removed. No dressing applied. Mouth wash prescribed.

³ Broders, A. C. Squamous-cell Epithelioma of the Lip. A Study of 537 Cases. J. A. M. A., March 6, 1920.

CYST OF PANCREAS

An examination of the fluid obtained revealed a cell count of 163 per c c with a differential count of 60 per cent polymorphonuclears and 40 per cent lymphocytes. It contained minute amounts of amylase, protease, sodium chloride, and sugar.

After the first two days very little leakage occurred from the wound. Ten days after operation there was a definite recurrence of the swelling in the left upper abdomen and he complained of a sense of fulness after eating, some pain in the left upper abdomen, and belching of gas with relief. The same physical signs were again obtained and repeated examination of the gastro-intestinal tract revealed much the same finding as before.

March 29, 1924, two weeks after the first operation in the Presbyterian Hospital, he was again operated upon, going through the upper part of the recent wound.

Much the same findings appeared. The omentum was opened and three litres of turbid straw-colored fluid was aspirated. This fluid was more turbid than on the preceding operation. This time, instead of using soft rubber tubing of the rubber dam type, ordinary rubber tubing was used, one tube passed behind the body of the stomach downward, and the other behind fundus toward the left.

Culture of this fluid showed staphylococcus aureus and it contained amylase, protease and lipase in very small amounts. It did suggest pancreatic secretion.

Following this second drainage of the lesser sac, the man felt better. He still had some pain in the left upper quadrant and digestive symptoms after eating, but at no time since then has swelling of the upper abdomen appeared. Leakage of clear pale watery fluid, occasionally containing lipase, continued in varying amounts for several months.

May 6, 1924, he was discharged from the hospital apparently improved but still draining fluid.

Closed permanently four and a half months after second operation.

CASE II—The patient, an adult woman, came to the Presbyterian Hospital, August 14, 1925. Six years previously she had been ill for four weeks with severe pain in the lower abdomen and rectum. She states that then something "broke" in her rectum quite suddenly and then she evacuated a large amount of pus with almost immediate relief of pain. For many years she had been constipated.

Her recent illness dated from June, 1925, when she began to have diarrhoea, followed by severe cramps in the abdomen, distention, and high fever. She was then acutely ill and these symptoms continued for about two weeks, after which she tended to improve.

A few days before admission she had a relapse of the same symptoms of fever, abdominal pain, vomiting, distention and prostration. She also had pain in her back and left upper quadrant. There had been absolutely no respiratory infection but just prior to admission she developed a pain in the right lower lateral chest, increased on deep breathing.

On admission the essential physical signs were as follows. There were signs of fluid at the lower posterior chest, but no change in position in the liver outline. Slight distention and definite resistance of the whole abdomen. Rigidity of the upper right quadrant. Pelvic examination normal. She was acutely ill, pale, sick, with rapid pulse of poor quality and high fever. Leucocyte count, 16,800. Polymorphonuclears, 87 per cent. Slight secondary anaemia. Urine normal. Examination of stool revealed no evidence of blood, ova or parasites. Pus was not reported but grossly stools appeared to contain much mucus with pus.

nancy is adopted, it will be impossible properly to evaluate statistics submitted for our consideration ⁴

It is assumed that the operator is familiar with the pathology of the two types of carcinoma of the tongue, the papillary and the infiltrating. The former is elevated above the surface of the tongue, and in its destruction and removal the monopolar current is effective. The use of the more penetrating current here is entirely unwarranted, and to do a hemiglossectomy or a Blair

operation for complete removal with glands in such a case is to cause needless mutilation.

Given a case of infiltrating carcinoma of the tongue we are warranted in deciding upon a hemiglossectomy for its removal. We believe one advantage of performing this operation by the endothermic method lies in the fact that, because destruction is destruction, destruction and removal of the virulent Grade 4 epithelioma is as sure by this method as is the destruction and removal of



FIG. 13.—Case F. H. Photomicrograph of squamous cell epithelioma of tongue. Grade 2.

the milder Grade 1 epithelioma, provided metastasis has not already taken place.

The Operation—Hemiglossectomy begins in the neck. An incision is made with the endotherm knife along the anterior border of the sternomastoid muscle. The lingual artery is ligated. We have also learned that it is wise to ligate the facial artery as well, since there are a few small branches that run from it to the base of the tongue and these may cause annoying hemorrhage. To prevent a possible subsequent troublesome collateral circulation, the external carotid artery is likewise ligated.

If any movable, non-painful, hard lymph-nodes are present, with the characteristic indurated "feel" of cancer, indicating that the glands are already carcinomatous, they are now dissected by the endotherm knife. Our conviction is that routine block dissection is as unwarranted as it is

⁴ Our own records are kept according to the Broders gradation. It will be noted that no tables of percentages are included in our report of cases, the reason being that in the less than five years during which this branch of surgery has engaged the writer's attention there have not been treated a sufficient number of cases of the different grades of malignancy to make such a table valuable.

futile, exposing the patient unduly to the danger of recurrence by tearing down nature's own wall of protection and at the same time opening wide the lymphatic channels. However, if the glands are to be excised, it had best be done by the endotherm knife, which seals lymphatics as it cuts. Small cigarette drain is inserted and the wound is sutured and heals by first intention. According to Kelly and Ward³ this primary union following incision by the endotherm knife is possibly promoted by the sterilization of the skin edges which is incidental to endothermy.

Turning our attention now to the lesion itself, we adjust the mouth gag and set the retraction suture transversely through the healthy side of the tongue. It is never necessary to split the cheek. With a draining needle bent to the proper shape, insulated by a strip of adhesive tape and held in a suitable handle, the malignancy is isolated by a path of protective coagulation necrosis. This is done beginning at the base of the tongue, well



FIG 14—Case E L

beyond the growth and working forward by thrusting the needle through the whole thickness of the tongue, point after point, along the midline to the tip. The tongue being elevated is next attacked from the lower side, taking in the floor of the mouth if necessary, until the starting point is reached and the coagulation path circumvallates the lesion. Specimen is now taken for the microscope, after which the entire indurated area is coagulated *in situ* by bipolar endothermy. With one turn of the switch the cutting current is brought into use and the coagulated mass is excised by passing the needle down the middle of the circumvallating path of protective necrosis already described. There is no bleeding, no surgical shock. An antiseptic mouth wash is prescribed and the patient is usually able to take liquid nourishment on the next day. A week later the stitches are removed from the neck, it being our custom to leave them in, after suturing an incision by the endotherm knife, for two or three days longer than is necessary after a scalpel incision.

³Kelly, Howard E., and Ward, Grant E. The Radical Breast Operation with the Endotherm Knife and without Ligatures. ANNALS OF SURGERY, January, 1926

Treatment by bipolar endothermy of a case of squamous-cell epithelioma, grade 2, of the floor of the mouth is illustrated by the Case J W, age sixty-six, a sailor, referred by Dr W B Moodie. Patient had noticed a soreness on the right side of lower jaw which he attributed to friction from a dental plate. His dentist assured him this was not the case and patient thereupon paid scant attention to the lesion. Not for some months did he seek medical aid. Then he went to a New York hospital where "the doctor opened it, and since then it has had a hole in it." Examination showed an indurated mass, about 3 cm x 2 cm in size, involving the right side of the floor of the mouth, with no palpable glandular enlargement. On June 2, 1921, under ether narcosis, the



FIG 15 —Case J D

entire mass was isolated from the surrounding healthy tissue by a line of coagulation. The bipolar current was used and in this case it was necessary to coagulate through the frenum, the under surface of the tongue and the inner surface of the right jaw. A section for microscopic examination was then removed with impunity, after which the whole mass was coagulated *in situ*. This coagulated mass was next removed by scissors and the cavity seared over lightly with the bipolar current to produce a further penetration of the endogenous heat. (To-day

this excision would be accomplished not by the scissors, but by the endotherm knife. In 1921, the cutting current had not yet been perfected.) Patient returned to room in good condition.

Next day there was considerable swelling of tongue and a profuse flow of saliva, but patient was free from pain and was able to take liquid nourishment. He left the hospital on the third day in fairly good condition, although toxic absorption had rendered him cachectic in appearance. Both sides of neck were given thorough X-ray radiation, and in four and one-half years there has been no recurrence nor metastasis.

CASE W W, age fifty-three, squamous-cell epithelioma of the tongue, recommended for treatment by endothermy by Professor John A Fordyce, was operated upon by the writer March 11, 1924, in conjunction with Doctor Whipple, who ligated the lingual artery. Presbyterian Hospital history, No 59,379, is abstracted to provide the following report:

Patient showed on right side of tongue an ulcer 1 cm in diameter, with the hard, curled edge characteristic of malignancy. Leukoplakia was present and the submaxillary nodules were swollen and somewhat tender. He had previously had salvarsan treatment without benefit. Wassermann reaction negative. After ligation of the lingual artery, the patient being under ether narcosis, endothermy was employed to perform a partial glossectomy. The circumvallating wall of destruction was begun at the back of the tongue and the lesion was isolated before being destroyed by bipolar endothermy and excised by the endotherm knife. Recovery was uneventful and eighteen months after the operation patient reported that his only complaint was that he was "putting on too much weight." There was no sign of recurrence or metastasis.

The case of F H, squamous-cell epithelioma, grade 2, of tongue, illustrated here-

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with, was referred by Dr Floyd Fischer. Several years previously a dentist had injured the under side of the tongue in extracting a tooth. This healed within a month and caused no further trouble until six weeks before patient's visit to the surgeon. Consulting a druggist about the soreness which developed at that time, patient was given a mouth wash "which burned it." Patient then consulted Doctor Fischer, who took a biopsy, and received from the Long Island College Laboratory, the diagnosis of squamous-cell epithelioma of the tongue. The left side of tongue was indurated about an ulcer with a crater-like centre. Submaxillary nodules and a sublingual gland on either side were slightly palpable, distinctly larger on the left side. February 26, 1925, the case was operated upon, under ether narcosis, and two days later patient left the hospital. On the 21st of March the mouth lesion was completely healed and neither then nor at patient's next visit in April were any glands palpable. For certain reasons no radiations were given the glands of the neck. On the 18th of July, however, the left sublingual and submaxillary glands were palpable and on the 21st, under local anæsthesia, were dissected out by the endotherm knife, without hemorrhage. The wound was sutured leaving a cigarette drain. Pathological report on these glands was Chronic inflammation, no evidence of malignancy. Operation was followed by Rontgen-ray radiation to both sides of the neck.



FIG 16—Case J D

In Case E L, age fifty-one, epithelioma of tongue, the lesion had begun as a small pimple, the exact nature of which the physician was unable to determine. He suspected syphilis, tuberculosis or cancer. A Wassermann reaction was taken and when the report came back "four-positive," anti-luetic treatment was instituted. There was no response to the first salvarsan treatment, so the physician became more energetic in its administration, and during six weeks he gave the patient eight injections¹. The lesion had continued for three months and had reached the state shown in Fig 14 before it was brought to the attention of a cancer specialist.

Bipolar endothermy was prescribed and applied under chloroform anæsthesia on March 29, 1922. The malignancy was isolated by a line of coagulation necrosis drawn across the tongue, well behind the lesion, and the entire isolated mass was coagulated and excised. Blood-vessels, lymphatics and sensory nerves were sealed off, there was no hemorrhage and no surgical shock.

Patient developed an acute psychosis and died on the tenth day. The lesson is to the family physician or general practitioner. Any lesion inside the mouth which resists treatment for more than three weeks should without further delay be brought to the attention of the specialist. It is well known that many cancer of the mouth cases are syphilitic, but a positive Wassermann reaction is not the only thing to consider in prescribing treatment.

H F W, a case of squamous-cell epithelioma, was referred by Dr James T Pilcher, with a history of swelling under right tongue of three months' duration, patient

was referred for treatment by endothermy after Doctor Pilcher had dissected out the glands on the right side of his neck

October 4, 1924, the patient under rectal anæsthesia, the lesion was first circumvallated by bipolar endothermy, destroyed *in situ* and then excised by endotherm knife. On the fourth day the man left the hospital and was cared for at his home. On two occasions upon the separation of eschars, sharp hemorrhages occurred which were controlled by packing. Prophylactic X-ray radiation was given both sides of neck. Patient began to gain at once, he returned to his work and his condition continues good with no sign of recurrence to date of this report.

The effectiveness of the monopolar current, rightly used, in removing papillary outgrowths on the tongue, is illustrated by the case of J. D. age fifty-five. At the time

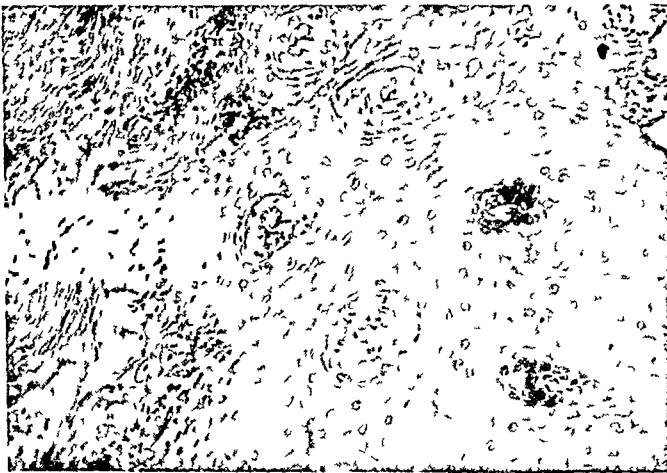


FIG. 17.—Case J. D.

of examination, the patient showed a wart-like growth projecting one-eighth inch above the dorsal surface of the tongue. It was white, corrugated and hard to touch. There were palpable submaxillary nodes and sublingual glands. The specimen for the microscope showed squamous-cell epithelioma, grade 1. Under local anæsthesia the growth was dehydrated in a single treatment and removal as dead tissue.

There was no post-operative treatment, for although

the patient was referred for Röntgen-ray radiation, he wandered away and did not attend to it. The second photograph was taken two years after the operation when chance brought the patient again to our notice. His general condition is excellent and there is no evidence of recurrence of the disease. This case is of interest not only as illustrating the effective destruction which may be accomplished by wise use of monopolar endothermy, but also as showing that glandular enlargement is not always a sign of glandular malignancy. These glands were almost certainly inflammatory in character and with the removal of the irritating mouth condition their swelling subsided, although two years later they were still slightly palpable.

It is a multiplicity of experiences like this one which leads us to conclude that bloc removal of glands of the neck as a routine part of the treatment of malignancy of the mouth and buccal surfaces is not warranted.

Combinations of endothermy with other agents in treating malignancy are often indicated, but that radiologist who announced that he had employed endothermy to clean out a mouth lesion after six weeks of treatment by radium seed implantations had missed the point of what endothermy offered his patient. We believe that the radium seed implantation represented the unjustifiable exposure of the patient to infection, septic absorption and toxæmia, the infliction of needless suffering, the loss of critically valuable time, the delayed return to full diet, and, finally, that there could be no certainty of the success of the dosage. Against this pain and delay and uncertainty the doctor had in endothermy a method which would have been

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prompt, cleanly, painless and exact. He was content to give his patient only a minimum of service from it while adhering closely to the old radium, tissue-conversion method for the main part of his treatment.

Our confidence in endothermy as a treatment for the removal of malignant lesions of the oral cavity, and our belief that better results will be achieved in the treatment of all neoplasms when endothermy is employed *in the beginning* in all those cases to which it is applicable, are based upon the record made by the method over a period of five years, a record made upon cases referred for treatment in many instances after surgery and physical measures—one or both—had failed. It is after careful consideration of the admirable results achieved by proper endothermic procedure that we affirm that endothermy should be given the preference in treating malignant lesions of the oral cavity. We enumerate the following explicit reasons for our belief:

1. By endothermy the extent of the destructive process is definitely under the control of the operator.

2. The effect of endothermy's destruction is immediate. The operator is not obliged to wait many weeks to determine just what has been accomplished by the forces he has set in motion.

3. Treatment by endothermy is followed by immediate cessation of pain. Sensory nerves are severed and capped.

4. This capping of nerves tends to eliminate surgical shock.

5. There is no post-operative reaction, and the patient is able to return immediately to normal diet.

6. There is no hemorrhage. The operator is spared the need of working in a field obscured by blood.

7. No other method offers endothermy's protection against the danger of recurrence and the threat of metastasis. The technic which isolates the malignancy, before its removal as dead tissue, by a path of protective destruction drawn in healthy tissue, and which thereby seals lymphatics to and from the affected part, is peculiar to endothermy.

8. Endothermy can be used in repeated treatments without prejudice to the patient. This is because lesion treated is destroyed and removed in a single operation without injury to surrounding tissue. The appearance of subsequent nodule or induration can be met with destruction and removal on precisely the same terms as the first lesion, if endothermy is the remedial agent.

For any and for all of these reasons endothermy should be given the precedence in the treatment of cases of malignancy of the buccal surfaces.

In directing attention to a new method, or to a modification of old methods, we are moved to quote what McArthur⁶ so effectively said at the meeting of the American Medical Association in St. Louis in May, 1922. Uging upon his colleagues the need, in certain instances, for operative procedures at variance with established surgical teaching, Doctor McArthur said: "Otherwise surgical judgment is banished and surgery becomes a set of formulas, the surgeon disappears and there remains only the operator."

⁶McArthur, Lewis L. Atypical Operations on the Jaws and Mouth for Malignant Growths. J. A. M. A., October 28, 1922.

TECHNIC OF USE OF REMOVABLE RADON SEEDS IN CARCINOMA OF THE TONGUE

By JOSEPH MUIR, M D
OF NEW YORK, N Y

THE high incidence of cancer of the tongue, its rapid development and likelihood of early glandular metastasis, and great disfigurement and functional impairment which often attend its surgical extirpation, and above all

the tremendous mortality associated with it, cause it to be one of the most dreaded of malignant neoplasms. In view of this fact it is rather surprising to find very few recent statistics concerning its incidence or other phases of the subject upon which it would be desirable to have exact information. Although recent literature offers many titles, a search for such figures usually leads us—often through a series of quotations and re-quotations—back to the work of Jessett published in 1886. This English observer studied the whole subject of buccal cancer very exhaustively, and by comparison of his own cases at the London Cancer

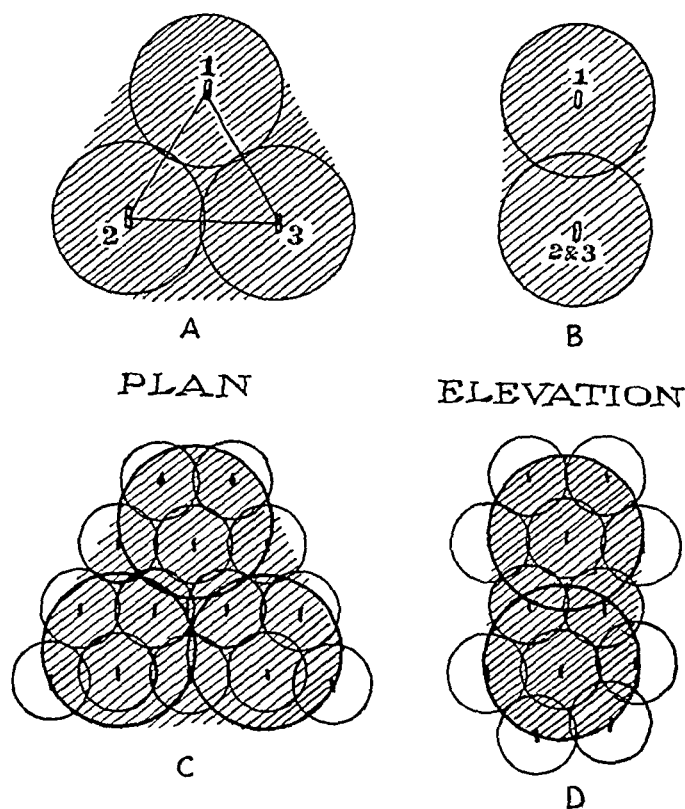


FIG 1—A shows the plane of the triangle with a seed implanted at each angle (the shaded area indicates the approximate extent of active radiation), B shows horizontal axis of triangular plane, Seed 1 appears as in A but Seeds 2 and 3 are shown super imposed (shaded portion shows approximate thickness of radiation), in C and D are demonstrated the number of unfiltered seeds required to radiate an equal amount of tissue, 30 to 40 bare seeds would be necessary to do the work accomplished by three radon platinum seeds

Hospital with those of other English and some German surgeons, placed the incidence of cancer of the tongue at 8 per cent of all malignant neoplasms, being exceeded in frequency only by breast cancer—31.3 per cent, and uterine cancer—12.3 per cent. Though these percentages may have altered slightly during the forty years since Jessett wrote, it is probable that they are not far from the actual figures, and are sufficiently formidable to emphasize the necessity of considering any and every possible means of successfully combating this grave and prevalent disease

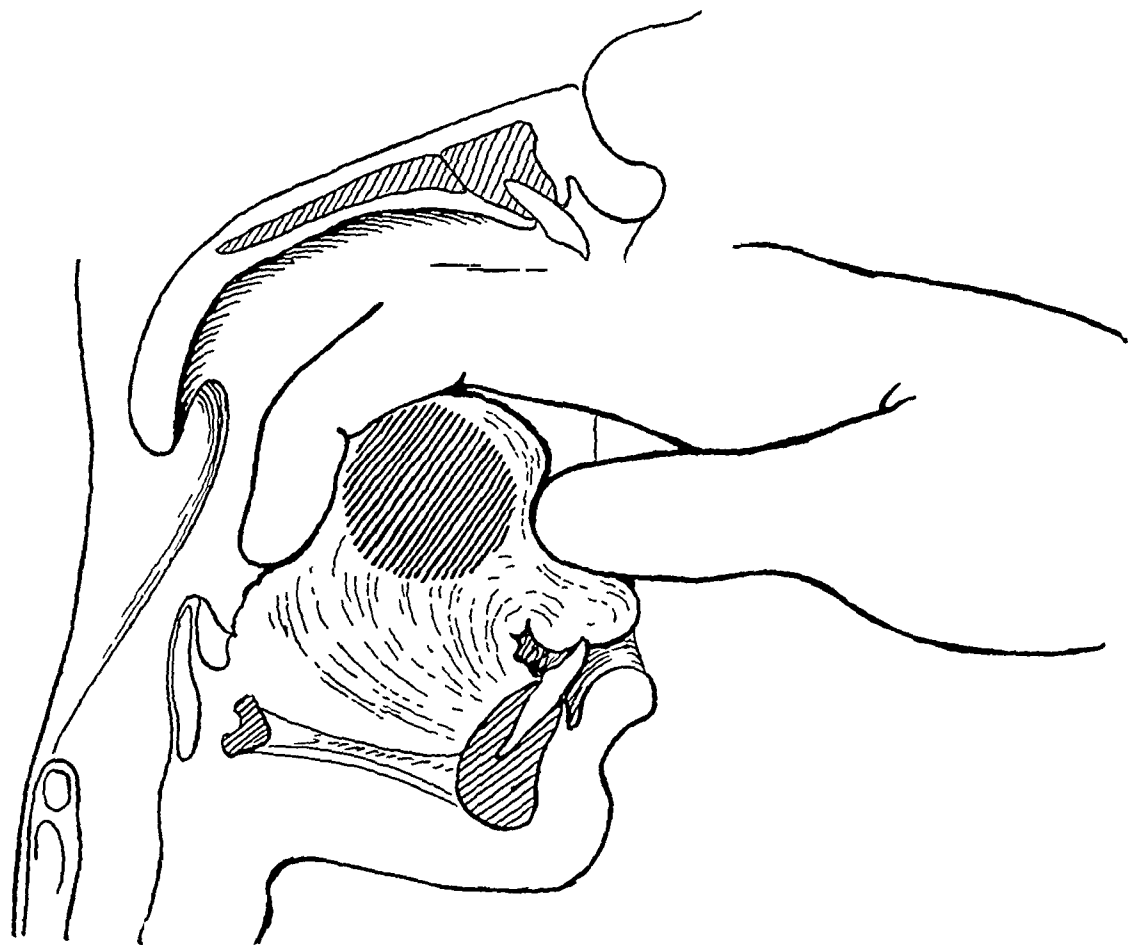


FIG 2a —Three-dimensional palpation of the tongue Antero posterior palpation

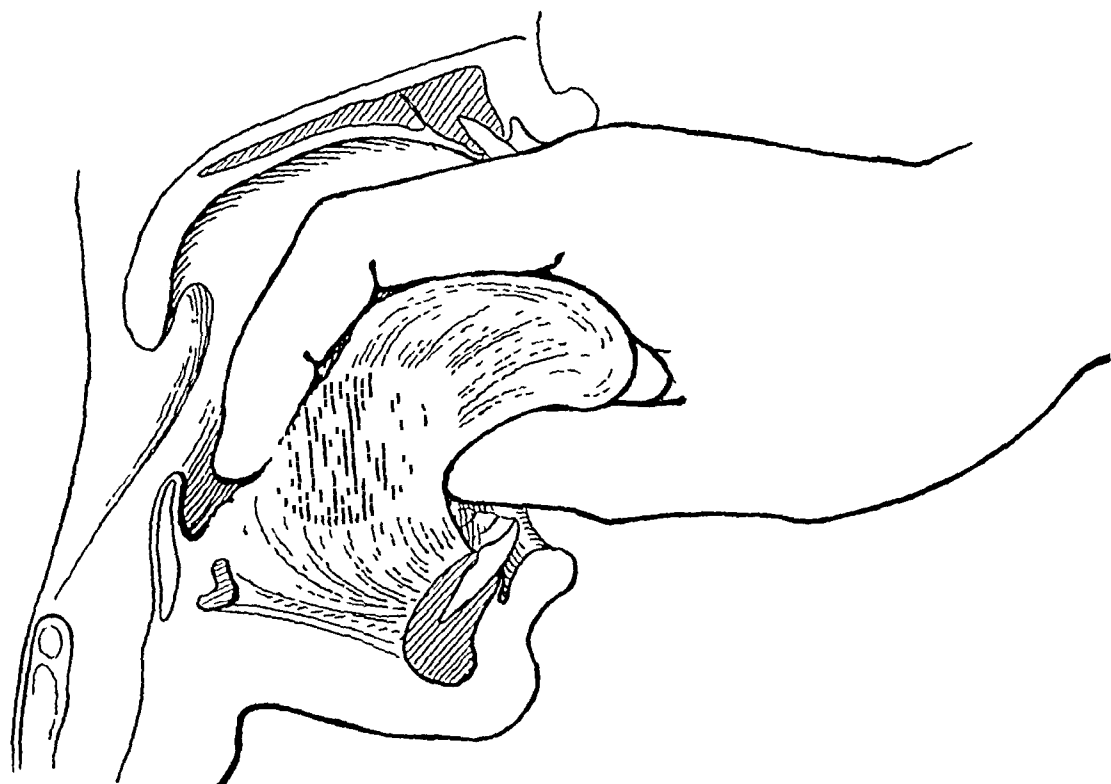


FIG 2b —Palpating vertical dimension

The age at which tongue cancer is likely to appear is the same as that of similar lesions elsewhere, most frequently in the fifth and sixth decade of life, though the incidence even past the age of seventy is still quite high. Unlike

many other malignant lesions, however, the factors of etiologic importance seem more fully established, for the general conception that constant irritation or continued slight trauma influences the location of malignant growths finds strong confirmatory evidence in all buccal neoplasms. Cancer of the tongue is seven times as frequent in men as in women, but in either sex there is practically without exception a history either of the excessive use of tobacco or the long-continued presence of diseased and broken teeth in continual contact with the lingual

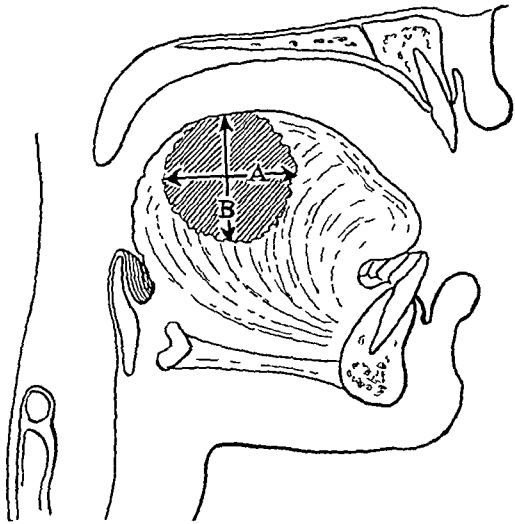


FIG 2c —Schematic representation of direction of palpation shown in a and b

mucous membrane. As Bloodgood has tersely put it: "Tobacco, rough and dirty teeth and improperly fitting plates predominate as causes of cancer of the tongue." Of this surgeon's 160 cases, only two did not use tobacco, as even "in the few cases of cancer of the tongue in women, the patients have used tobacco, usually in the form of snuff by the mouth." The two men who did not use tobacco both had a long history of bad teeth, with injury to the tongue from contact with a broken tooth. All writers seem to agree that chemical irritation contributed by the tobacco itself, or the necrotic products of diseased teeth are quite as dangerous as the mechanical effects from smoking burns, or wounds from ill-fitting dentures or broken teeth.

As regards the importance of syphilis as a predisposing factor, there appears to be considerable difference of opinion. But the coincidence of syphilitic buccal lesions with subsequent malignancy in the same area, is too frequent to permit of its being disregarded.

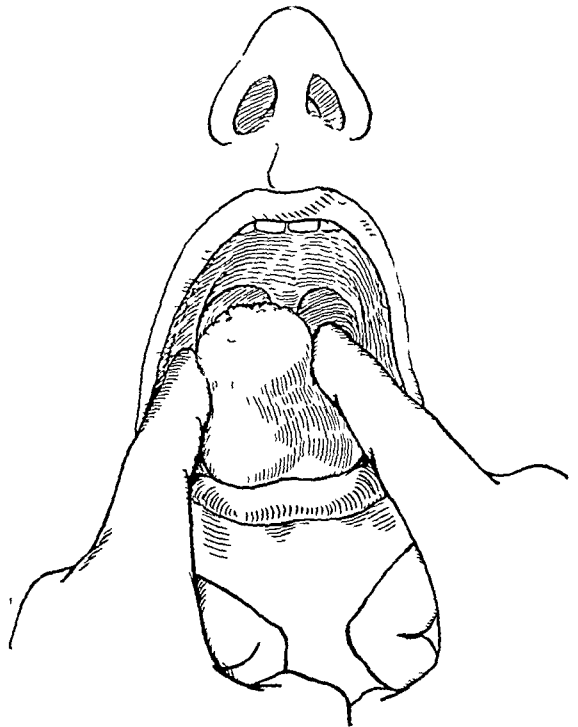


FIG 3a —Palpation of lateral dimension

RADON SEEDS IN CARCINOMA OF THE TONGUE

Taussig's caution that an untreated syphilitic lesion of the tongue should always be watched with suspicion, especially when subjected to the trauma of the excessive use of tobacco or of a rough tooth, and his assertion that the recognition and proper treatment of syphilis of the mouth and proper dentistry will undoubtedly lessen the frequency of cancer of the tongue, are deserving of thoughtful consideration by everyone interested in reducing the incidence of this particular malignant lesion.

The mortality in untreated cases of tongue cancer is very high, at least three-quarters of those thus neglected dying within six months.

But unfortunately, treatment, while it reduces the immediate mortality somewhat and has lowered the other distressing figures considerably, on the whole has never proved in any degree satisfactory, so that whatever may be put forward offering a chance of better results, will be widely

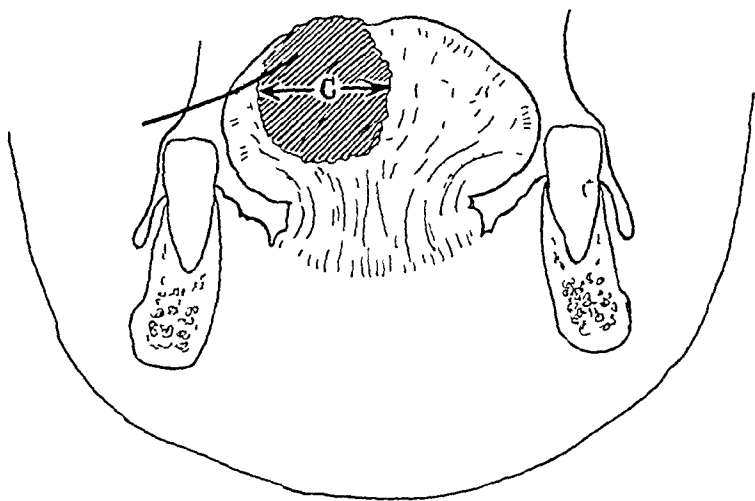


FIG. 3b—Schematic representation of results obtained by a

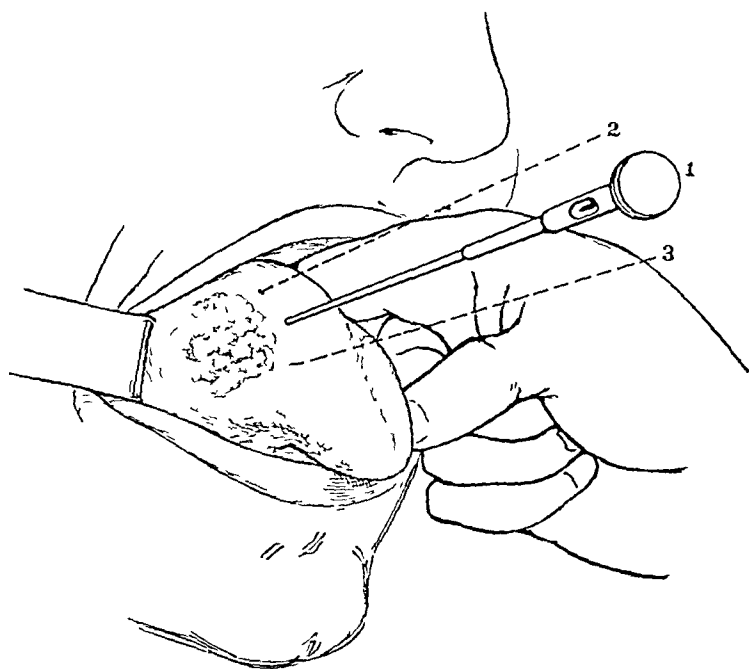


FIG. 3a—Implantation of a lateral border lesion. Counter-pressure is being made with the thumb as the seeds are placed.

welcomed. Up to a few years ago, surgery was the only method of cure which could in any way claim to be successful, although this is actually applicable to but a small proportion of lingual malignancies. When the discoveries of Rontgen and the Curies added radiotherapy to the physician's armamentarium, high hopes were raised that a means had at last been found of combating cancer of the tongue wherever located, but

the history of the past twenty years shows that these hopes—though by no means ill-founded—have been realized only in very small part. Yet the most far-sighted of radium therapists saw that while surgery had attained its maximum efficiency in this particular line of endeavor, the possibilities of

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Aspiration of the right lower pleural cavity behind yielded a little fluid containing polymorphonuclears, which suggested a nearby pyogenic infection. Her blood culture proved sterile.

Fluoroscopy and X-ray examination of the chest indicated a small amount of fluid in the right costophrenic angle but fluoroscopy suggested nothing to indicate a subdiaphragmatic abscess.

Operation Under Gas and Ether, August 16, 1925—On opening the peritoneal cavity, through the right rectus incision, there was a small amount of slightly turbid free fluid. The great omentum was found on the superior aspect of the liver, over the right lobe, where it was adherent by fine fibrinous adhesions in the shape of a great flat disc, about 15 cm. in diameter. This disc was somewhat bluish, very indurated and apparently the site of acute inflammation. The pedicle of the disc was normal omentum. This disc of omentum was easily separated from the upper surface of the liver and under surface of the diaphragm, leaving slightly bleeding surfaces. The liver was otherwise made out normal. There was no suggestion of an abscess nor of multiple abscesses. It was but slightly if at all enlarged. There was no subphrenic accumulation. It was only after the displacement of this disc of omentum that the subhepatic space could be explored. The gall-bladder was nowhere to be found, but in its space lay a definite cystic mass which was at first thought to be an abscess. It lay rather deep in the posterior wall of the peritoneal cavity to the right of the duodenum and beneath the posterior part of the right lobe of the liver. After exploring this fluctuating surface it was aspirated, when perfectly clear fluid appeared in the syringe. It resembled spinal fluid. Having discovered that this was no abscess, it was left alone, and the exploration continued. Passing the hand down the abdomen a mass was found just below the umbilicus beneath the anterior abdominal wall. In exploring this mass, the finger entered a pocket and thick, foul-smelling, yellowish-brown pus appeared upon the examining glove. This evidently meant a localized, peritoneal abscess, just below the umbilicus. Passing the hand down the right lumbar gutter and toward the pelvis, nothing else could be found. There was apparently no evidence of appendicitis because the abscess seemed to have no connection with the right lower quadrant. It was thought possible that this was due to a Meckel's diverticulum or was an infected cyst of the urachus.

The peritoneal abscess was drained through a lower right rectus incision and a jejunostomy was done through a small wound in the left upper abdomen. The jejunostomy appeared indicated because of the evidence of an acute diffuse peritonitis, with distention and vomiting.

She was acutely ill for several days after operation, but except for the signs of a mild post-operative pneumonia, she was slowly but steadily improved.

Culture of the cyst fluid was sterile. No pancreatic ferments were present. Culture of the pus from the peritoneal abscess showed hæmolytic staphylococcus aureus.

For a long time she continued to run a temperature of 99 to 101. She left the hospital September 15, 1925, and for two or three months subsequently continued to have slight fever and elevation of pulse. Her strength has increased and now she has occasional temperature of 99 with a slightly elevated pulse.

She still has the signs of what is thought to be thickened pleura at the right base. Her digestive tract is functioning satisfactorily except for slight tendency to constipation. There is a ventral hernia.

radiation were but just beginning to be appreciated, so that the constant widening of our knowledge of its powers, together with the continually increasing

exactness of the technic of its application, gave every promise of much greater usefulness yet to come

Clinically, we recognize three sites upon the tongue where cancer may be located. First, upon the forward dorsal surface, either at the edge or medially, second, upon the posterior dorsal surface, that is, "the root", and third, beneath the tongue, upon the under surface of the floor of the mouth. Of the lesions thus variously located, only the first—the tip of the tongue—has been successfully extirpated often enough to warrant its being called "amenable to surgery."

When seen early, before extensive infiltration of the lingual tissue has occurred, or glandular metastasis has taken place, surgical excision has often given excellent permanent results. Unfortunately, few of these neoplasms are seen early, and many of them are located elsewhere than upon the end of the tongue, for this reason the record of surgical cure is not a brilliant one, and no one realizes more than the experienced surgeon, how little his skill will avail in the majority of cases.

Because of the terrible mutilation produced by most of the surgical interventions and high primary mortality which attends them, electric coagulation and the application of X-rays and radium were advocated as treatments for tongue cancer very early in the history of these different therapeutic aids. The

results of these physical agents appear on the whole to be better than those of surgery, but there is a strong feeling on every hand that a vast improvement over anything that has been accomplished up to the present is highly desirable. One of the pioneers in radium therapy of tongue cancer was the Memorial Hos-

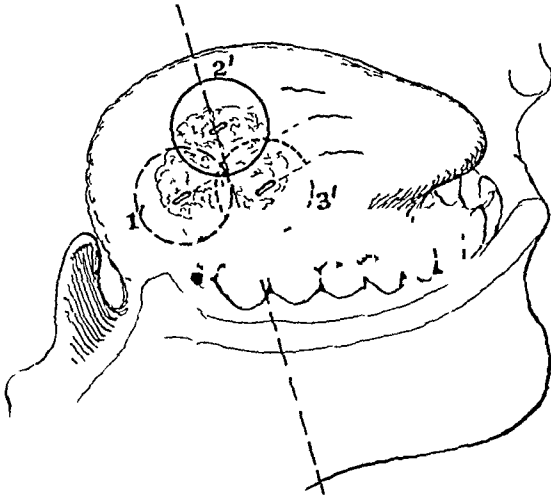


FIG 4b—Distribution of implanted seeds in relation to normal tissue, the lateral aspect is schematically presented with Seeds 1, 2 and 3 disposed in the antero-posterior plane, the thread end is seen protruding from the implanter's point of entrance as shown in a, irregularly shaded area indicates malignant tissue

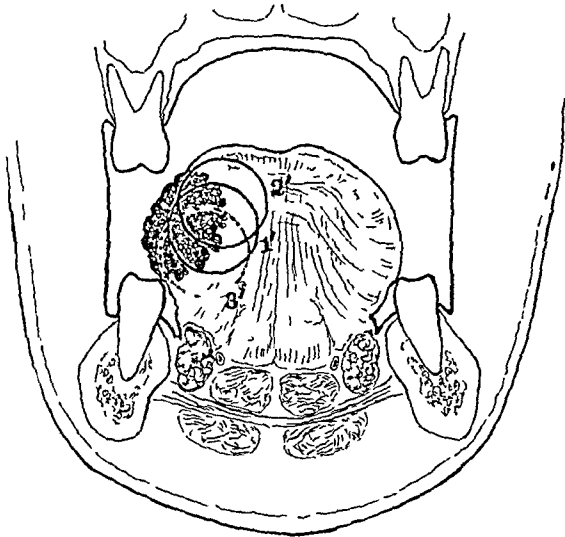


FIG 4c—Circles 1', 2' and 3' show extent of radiation from Seeds 1, 2 and 3. The plane of frontal section is indicated by the straight broken line

RADON SEEDS IN CARCINOMA OF THE TONGUE

pital, New York, but their first report made in 1916, did not offer great encouragement. Up to that time they had employed only external or surface applications and had found that in lesions over one centimeter in diameter, this method offered little chance of permanent cure. Shortly after this they adopted the plan of using bare tubes of radium emanation, which were buried in the growth, and following the employment of this technic their results steadily improved. Tubes not over one millicurie in strength were buried uniformly throughout the growth by means of fine trocar needles, the total dosage amounting to from 6 to 15 mc left *in situ* so that each millicurie gave approxi-

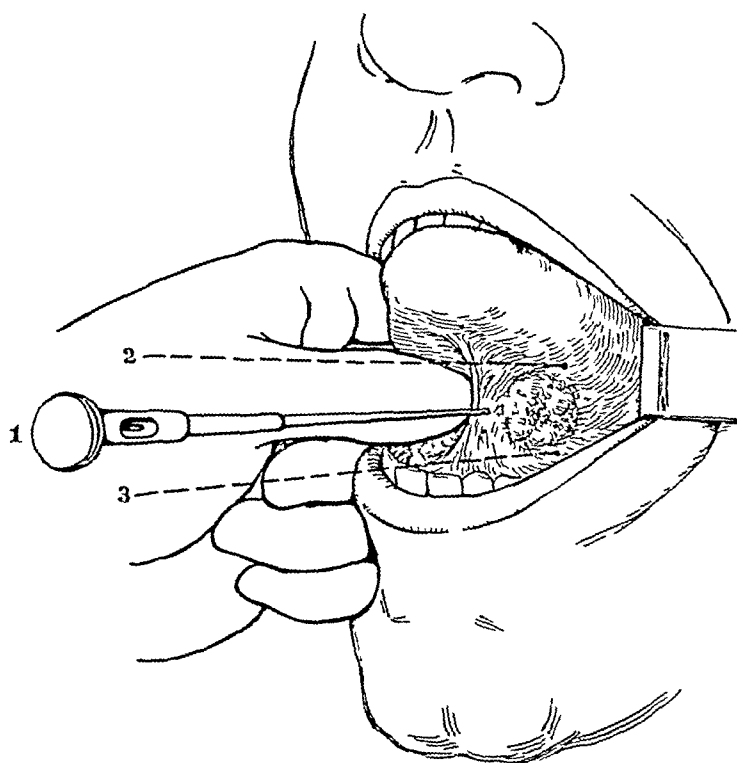


FIG 5a —Method of implanting lesion at root of tongue

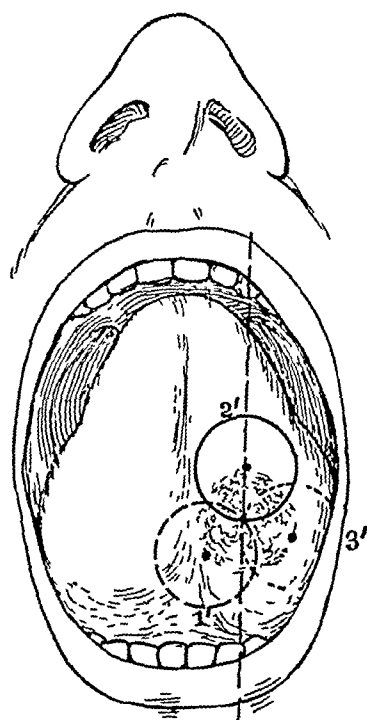


FIG 5b —The radiated area viewed from in front the tongue being upraised

mately 132 hours of continuous radiation. The very prolonged beta and gamma radiation which they obtained by the use of unfiltered glass containers, they regarded as superior to the shorter exposure of mainly gamma rays where metal containers with large amounts of the element were placed in the growth for periods of only a few hours. In 1923, Quick reported 128 cases treated by this method. Metastasis to the cervical glands was treated by external radiation where the neck was free from palpable involvement, when involved a conservative dissection was first carried out, and very weak tubes of radium emanation thereafter buried throughout the wound.

In France the most brilliant and satisfactory work in radium therapy of tongue cancer has been done by Claude Regaud, director of the Paris Radium Institute, who presented his results before the Strasbourg Radiologic Congress in 1923, and again last July, at London, at the meeting of the First International Congress of Radiology.

In obtaining his results—which were hailed by his hearers at the London

Congress as the best ever given for the cure of tongue cancer, far exceeding any ever claimed for surgery—Regaud was governed by the following rules

Use only gamma rays, thus avoiding all necrotic action

Employ continuous radiation of long duration, the intensity of the dose being gradually reduced during the period of application

Depend for success upon a single treatment, for repeated dosage may render the neoplasm radioresistent

Distribute many radioactive centres of low intensity throughout the malignant lesion and in the apparently healthy tissue surrounding it, using care to distribute the entire dose as evenly as possible

When he failed of success he found that the total dosage had been insufficient, the radioactive centres had been unevenly distributed so that there was too much radiation in one place and not enough in others, the applicators were defective, either in the filtration which they provided or the form of radium which they contained, or necrosis had taken place

To avoid these causes of failure he made use of platinum needles, 0.5 mm thick, which he regarded as superior to bare tubes or needles with insufficient filtration. He emphasized the advantages which radium emanation

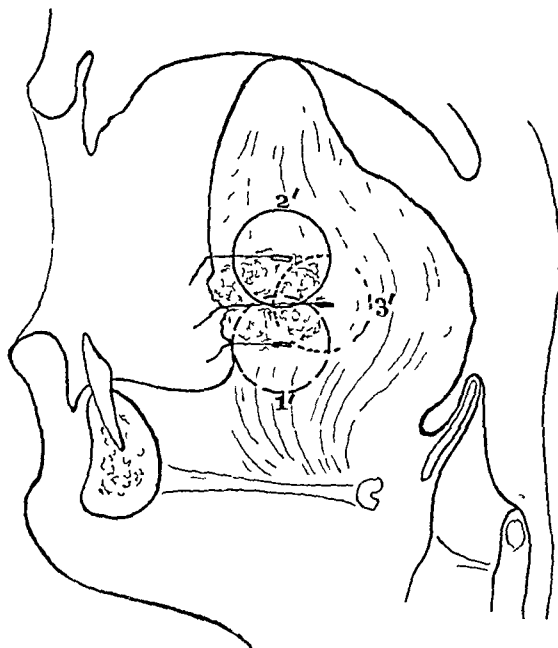


FIG 5c—Shows plane of antero posterior section (indicated by broken line on 4b). Circle 2' coincides with the plane of section, Circle 1' being below and Circle 3' above

offers over radium salts for use in these platinum needles. The size of the malignant growth was estimated with the greatest exactitude, and the needles implanted throughout at carefully spaced intervals. The methods of measurement are not described. In the discussion of this paper before the London Congress, Regaud added that the needle method was only efficacious "when access to the neoplastic region is easy," a condition obtaining only in cancers on the anterior dorsum or below the tongue. He regarded the 0.2 mm thick gold tubes which had just been put forward by Quick and Failla of the Memorial Hospital as an important advance step, but still felt that the filtration thus provided was inadequate. Nothing short of 0.4 mm of platinum would be absolutely protective, and this made too large a foreign body to be safely left in the tissues. For this reason he favored needles, as they could be withdrawn at pleasure.

The factors still to be sought in order to provide a wholly adequate radium technic, as listed by the man acknowledged by the assembled radiologists of the world as the most successful therapist of cancer of the tongue, I believe

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to be all included in that which I am about to describe. These factors are Adequate platinum filtration, doing away with all danger of necrosis small size, so that the implantation of the applicator induces a minimum of trauma, possibility of accurate measurement even of the most inaccessible lesion, insuring even distribution of radiation, complete intra-neoplastic insertion so

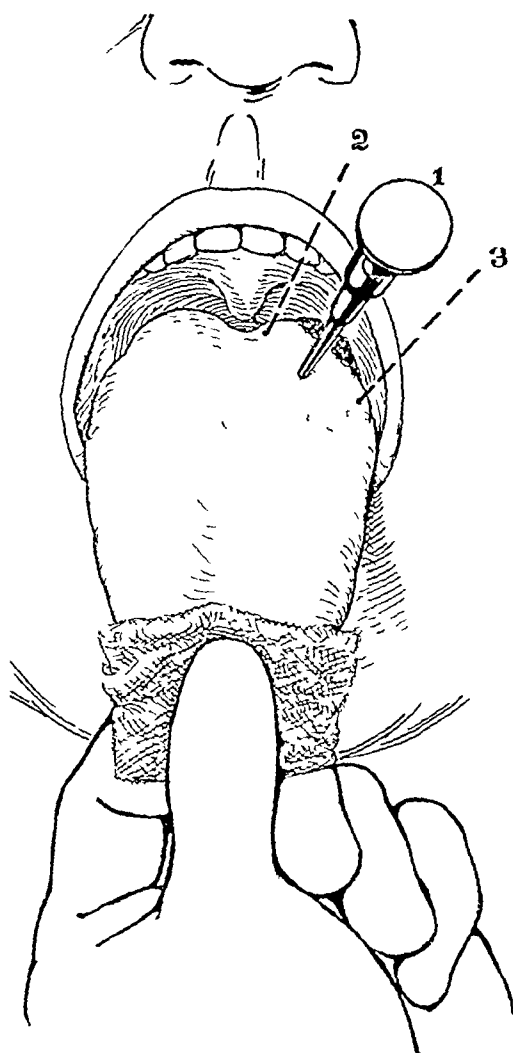


FIG 6a —Showing implantation in a low lesion far back at the base of the tongue in which successful counter-pressure may be impossible. Stippled area represents the invisible portion of the growth which should be visualized by the operator through careful palpation. A small margin of the growth is to be seen on the left upper edge of the tongue.

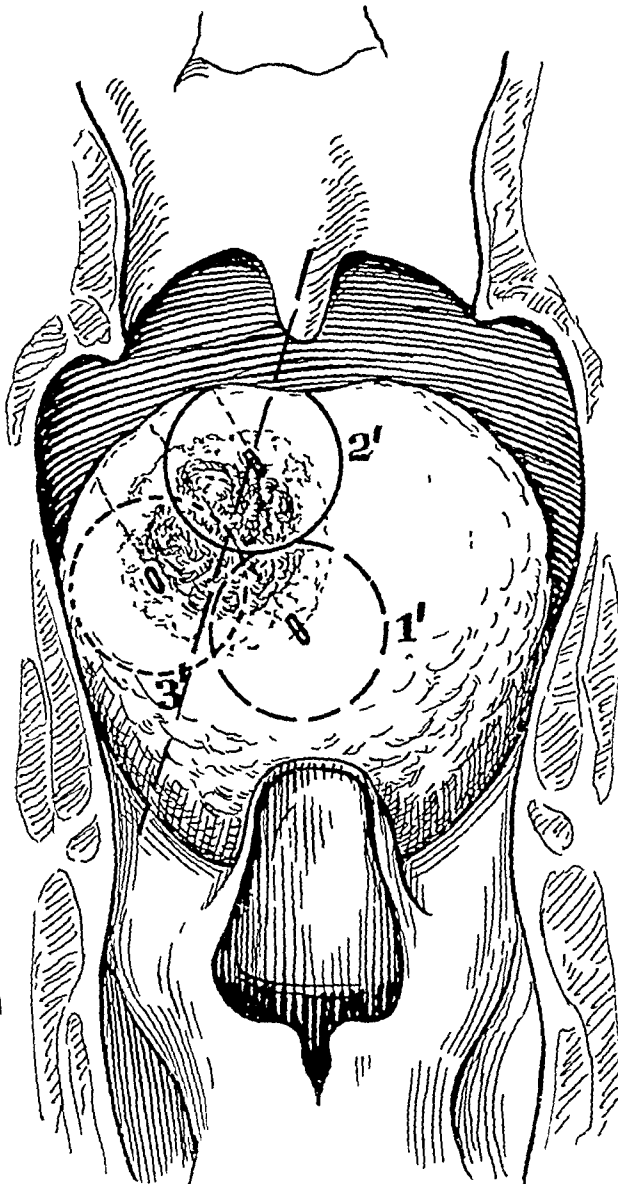


FIG 6b —Shows disposition of seeds on the posterior aspect of the tongue. The broken line passing through Circle 2' represents the plane shown in 6c.

that there is no chance of dislocation nor expulsion of the applicator before a sufficient exposure has been made, and finally, easy and complete removal whenever it is desired to conclude the treatment.

Instead of the needles advocated by Regaud I employ a removable platinum radon "seed." I have found that a filter as thick as 0.4 mm. of platinum is not necessary, because, according to the experiments of Lacassagne, when using filtration of 0.3 mm. platinum, during a twelve-day exposure necrosis begins only when the radioactive centre has a value of 7 millicuries. By

limiting the amount of radium emanation employed in a single centre to 2.5 millicuries, no evidence of necrosis has ever followed any of my implantations.

The "seed" is so minute that its implantation causes little or no trauma,

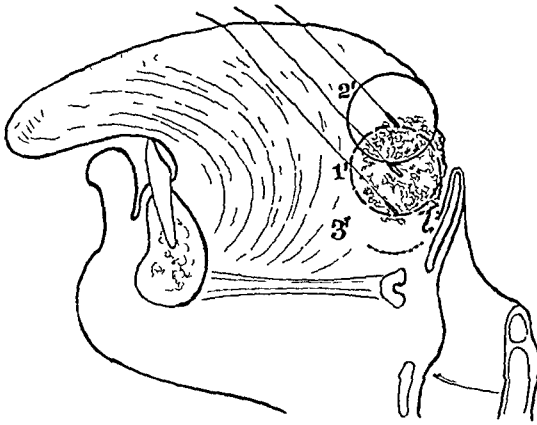


FIG 6c

its dimensions being practically the same as those of the bare tube previously used, while the fact that each "seed" can safely produce an intensity of from five to ten times that possible by the old bare-tube method greatly reduces the number of seeds required to insure complete radiation of a given neoplasm. The proper distribution of this radiation is attained through a precise preliminary estimation of the size of the lesion, and the exact placing of

each seed, which can be accomplished no matter how surgically inaccessible the lesion may be. The seed may be of any length desired, being radioactive throughout, so that its dimensions can be adapted to the depth or breadth of the area to be treated, thereby reducing the total number of seeds required to insure complete radiation. The seed is completely buried in the malignant tissue, thus sharing all the bare tube's advantages over the needle as regards retention of position and non-interference with function of the surrounding parts. Finally, an attached thread makes it readily removable when sufficient radiation has been given. The thread ends can be cut off so short that their presence causes the patient no inconvenience, while if the implantation is done under proper aseptic precautions there is no more danger of infection being conveyed by the thread than there is of sutures becoming infected in internal surgery. The "stitch-abscess" is everywhere regarded as the hallmark of the inefficient surgeon, and failure to

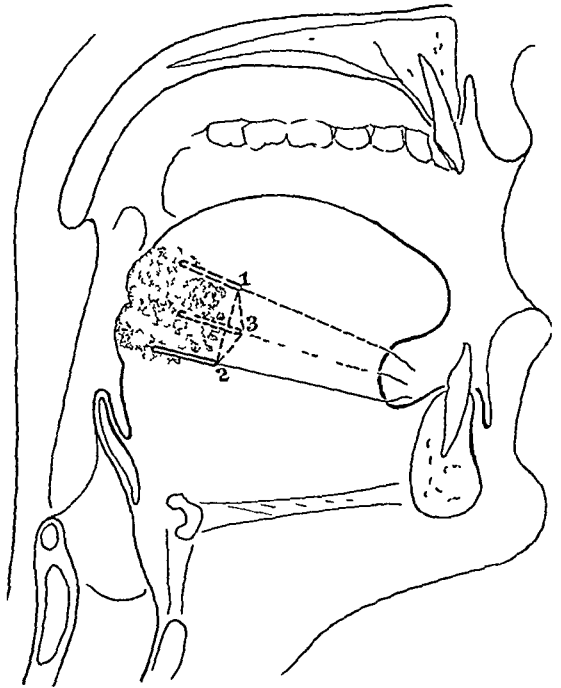


FIG 7—Shows implantation when long centres of radioactivity are used. The completely closed platinum radon seed does not offer any chance of necrosis such as is afforded by the needle open at both ends.

observe every aseptic precaution is exactly as reprehensible in the radiologist. As soon as the seed is withdrawn the channel kept open by the thread immediately closes, and has never given us any trouble thereafter.

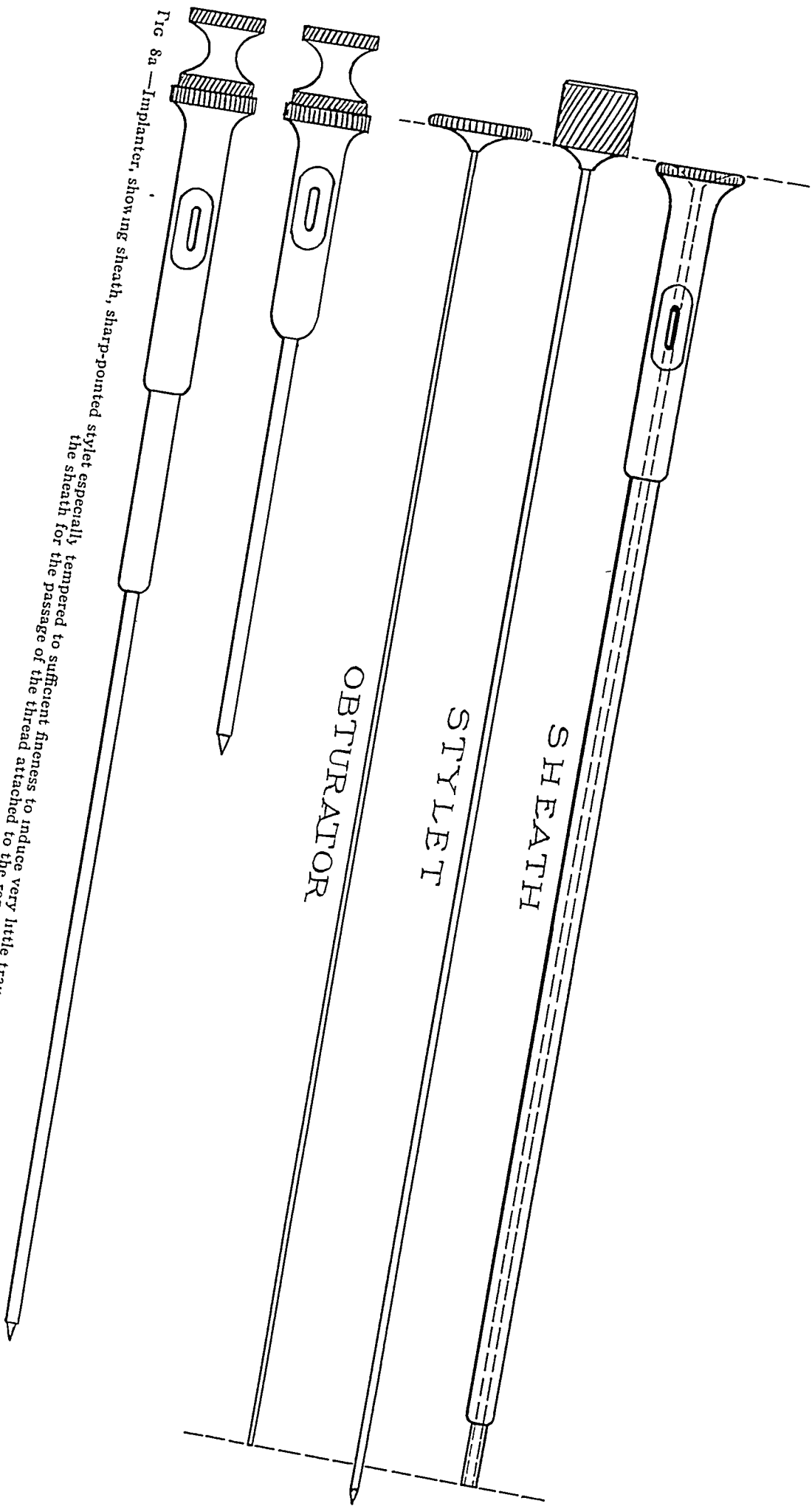


Fig 8a—Implanter, showing sheath, sharp-pointed stylet especially tempered to sufficient fineness to induce very little trauma to the tissues and to leave room in the lumen of the sheath for the passage of the thread attached to the removable seed

Technic —The technic depends for its success upon proper distribution of the radiation, which can only be attained by exact measurement of the lesion. The operator must visualize one or more equilateral triangles at the angles of

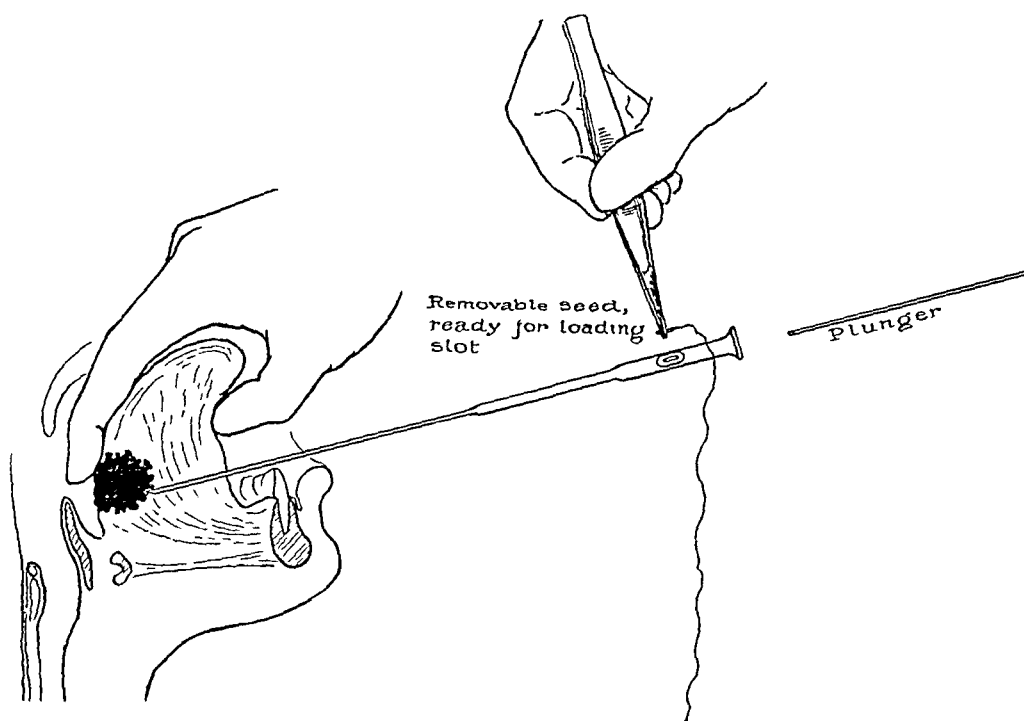


FIG 8b —Implanter in position for placing seed Plunger held in readiness to drive seed home

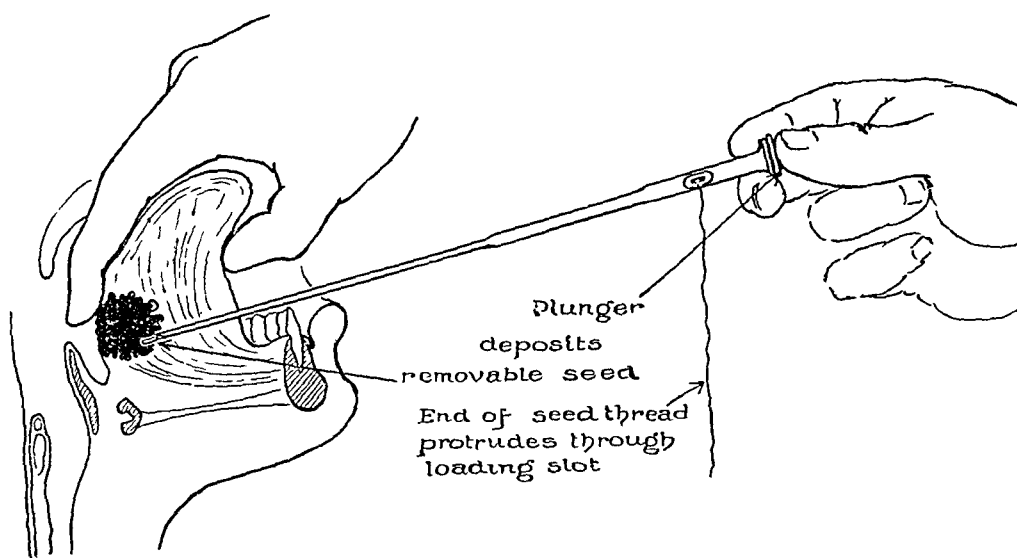


FIG 8c —Operator's hand pushes seed into its place by means of plunger, seed-thread drawn into lumen of implanter as seed is pushed down

which the seeds are implanted. The length of each side of the triangle must be twice the length of the radius of radiation from the seed, that is, if the radius of radiation be 1 cm, the sides of the triangle should be 2 cm long

RADON SEEDS IN CARCINOMA OF THE TONGUE

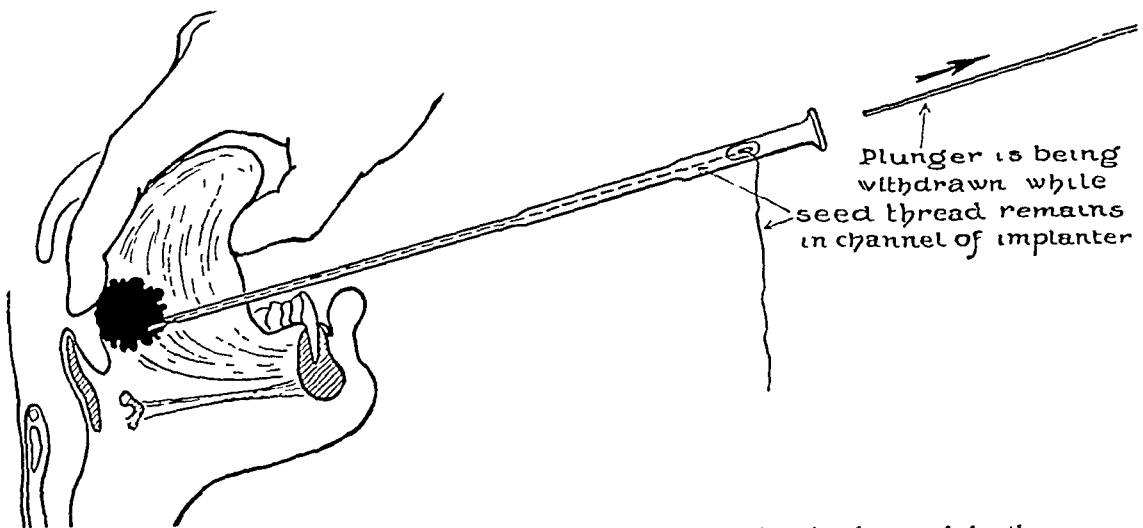


FIG 8d —Seed in place, plunger being withdrawn, leaving thread in lumen of sheath

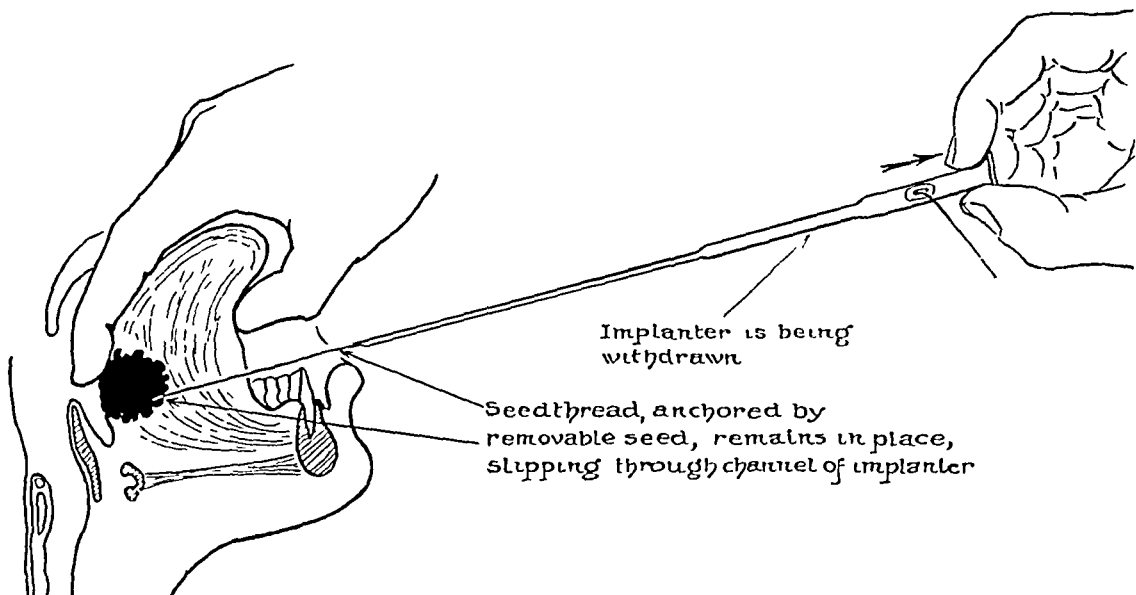


FIG 8e —Implanter withdrawn in direction of its long axis, so as not to displace seed by traction

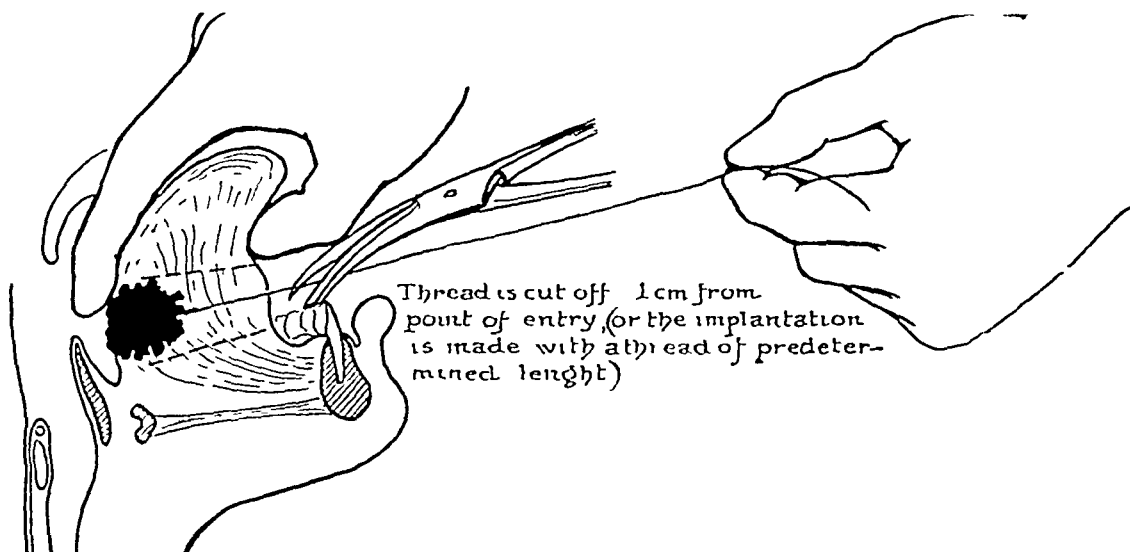


FIG 8f —Thread is cut off dotted lines extending from root of tongue toward malignant area indicate course of other two seeds each thread being cut off on withdrawal of implanter taking care not to displace by traction

The area of tissue radiated about the seed is represented on the diagrams as a circle upon a plane surface, but the operator must consider it in his mind as a sphere or globe with the seed in the exact centre

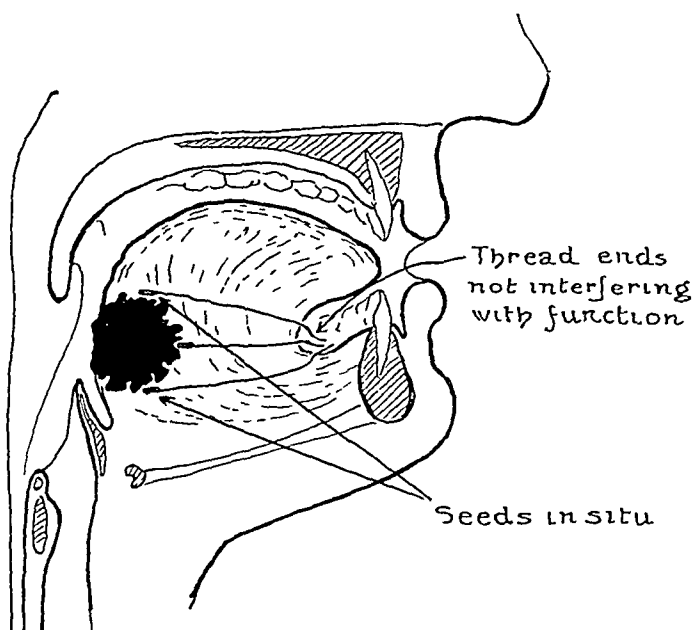


FIG 8g —Seeds *in situ* threads cut off, no interference with function

In Fig 1 (a) is shown the plane of the triangle with a seed implanted at each angle (the shaded area indicates the approximate extent of active radiation), (b) shows horizontal axis of the triangular plane, here, the position of Seed 1 appears as in (a), but Seeds 2 and 3 are shown superimposed (shaded portion indicates approximate thickness of radiation) In (c) and (d) are shown the number of unfiltered

seeds which would be required to irradiate an equal amount of tissue, for as each bare seed can irradiate but 1 cm, it would require from thirty to forty unfiltered seeds to furnish radiation equivalent to that supplied by three platinum radon seeds

Figures 2 and 3 show three-dimensional palpation in cancer of the tongue In Fig 2 (c) Arrow A indicates the direction of antero-posterior measurement, and Arrow B vertical dimension, in Fig 3 (b) Arrow C shows lateral dimension

In Fig 4 (a) is shown implantation of a lateral border lesion Counter-pressure is being made with the thumb as the seed is placed

Distribution of implanted seeds in relation to neoplastic area is shown in (b) and normal tissue in (c) In (b) the lateral aspect is schematically presented with Seeds 1, 2 and 3 disposed in the antero-posterior

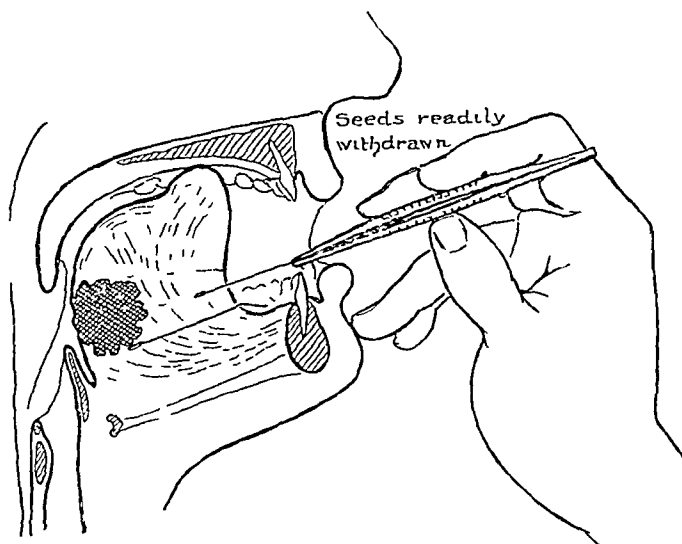


FIG 8h —Withdrawal of seeds when desired period of radiation is completed

Fig 9—Carcinoma of the under-surface of the tongue. Sub-dorsal malignancy may be located beneath the dorsum or upon the floor of the mouth

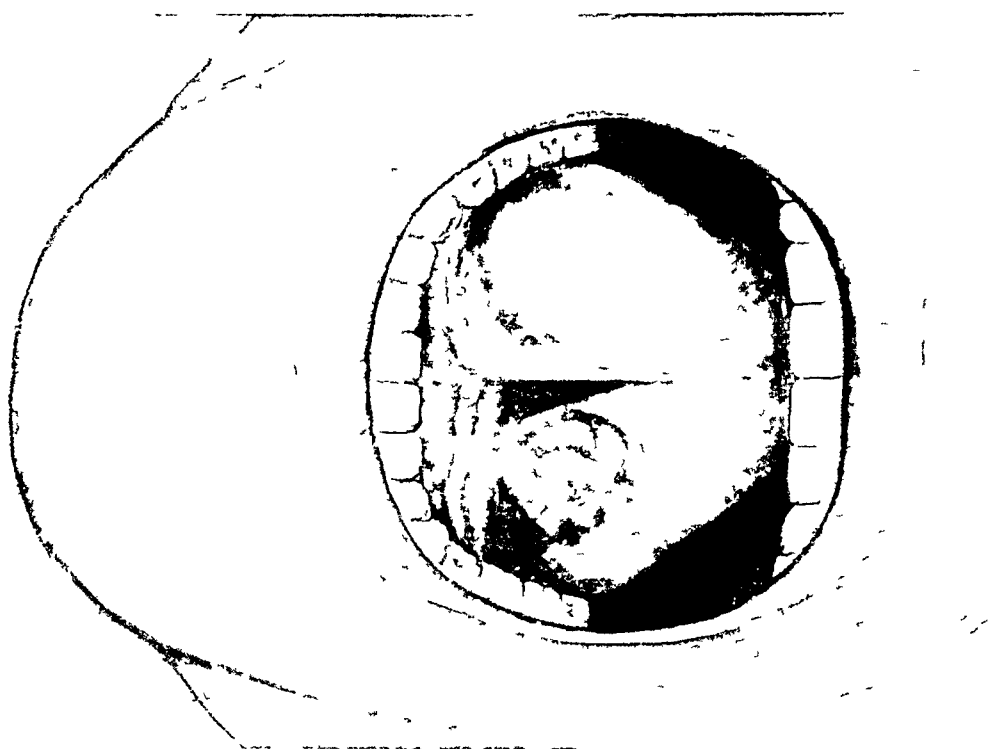


Fig 10—Carcinoma of the edge of the tongue. The lesion here illustrated is located somewhat farther back than those which are usually regarded as amenable to surgery



HIGH ENTEROSTOMY FOR ILEUS AFTER APPENDICITIS

This woman is now thought to have had a pseudocyst of the pancreas associated with a preceding acute atypical pancreatitis. She is to be frequently observed over a long period.

ADENOCARCINOMA OF SIGMOID COLON

DR SEWARD ERDMAN presented a man, who was admitted to the New York Hospital, October 14, 1916, aged sixty-six years. The history ran back for half a year, during which time he had had occasional passage of blood and mucus by rectum. Occasional faint attacks and recently two attacks of obstipation with vomiting, with loss of weight and strength. Examination showed a nodular sloughing tumor hanging down in the mid-rectum, apparently invaginated from above.

October 30, 1916, an exploratory operation was performed which revealed the lower sigmoid invaginated into the upper rectum. This was easily reduced and a tumor was palpated in the sigmoid, measuring about 4 inches in diameter. The entire loop was drawn out of a left inguinal incision and the wounds closed about it. The Mikulicz method was followed. On the fourth day the loop was removed with the cautery. Later clamps were applied to the spur, and on December 6 the artificial anus was closed by Lembert sutures of the gut and simple closure of the skin under local anæsthesia. No attempt was then made to prevent a hernia. The wound rapidly closed, but a slight hernial protrusion has always remained.

The patient gained weight and has remained perfectly well for these nine years.

DR CHARLES L. GIBSON remarked that he had a patient living thirteen years after a three-stage resection. At the time of operation 20 inches of gut were taken out and in the cut end of the meso there were cell nests found. The wound was kept open for four months and the cautery was used on the edges, which probably accounts for the patient being alive to-day. In another case large nodes were found which were carcinomatous. That man is alive and working seven years since the nodes were taken out.

HIGH ENTEROSTOMY FOR ILEUS AFTER APPENDICITIS

DR SEWARD ERDMAN presented a woman, aged thirty-four, who was admitted to the New York Hospital, June 8, 1924.

Two and one-half days before admission, she had been ill with general abdominal pain, localizing in the suprapubic region, with fever (101) and persistent vomiting.

On admission both lower recti were rigid, and a pelvic mass was palpable.

First operation, June 8, an immediate laparotomy was performed through a right paramedian incision. There was free turbid fluid. A mass filled the pelvis, consisting of thick creamy pus with foul odor, forming an abscess about a sloughed appendix, which was bound to the back of the uterus. Appendix removed and wound lightly closed about two drains to the cul-de-sac. Culture showed bac coli communis.

The post-operative course was very stormy, with high temperature, much distention and recurrent vomiting, and much purulent drainage.

Second operation, on the ninth post-operative day, after several days of obstipation, distention and continuous vomiting, a jejunostomy was performed under local anæsthesia. Drainage averaged over 600 c.c. daily for five days, with relief of distention and vomiting. The tube was removed after five

plane The thread end is protruding from the point of entry of the implant as shown in (a), irregularly shaded area indicates malignant tissue Circles 1', 2' and 3' show extent of radiation radius from Seeds 1, 2 and 3 The plane of frontal section is indicated by the straight broken line

Figure 5 indicates the method of implanting a lesion at the root of the tongue, (b) is the radiated area viewed from the front, the tongue being upraised The plane of antero-posterior section [indicated by broken line on 4 (b)] is shown at (c)

Circle 2' coincides with the plane of section, Circle 1' being below and Circle 3' above

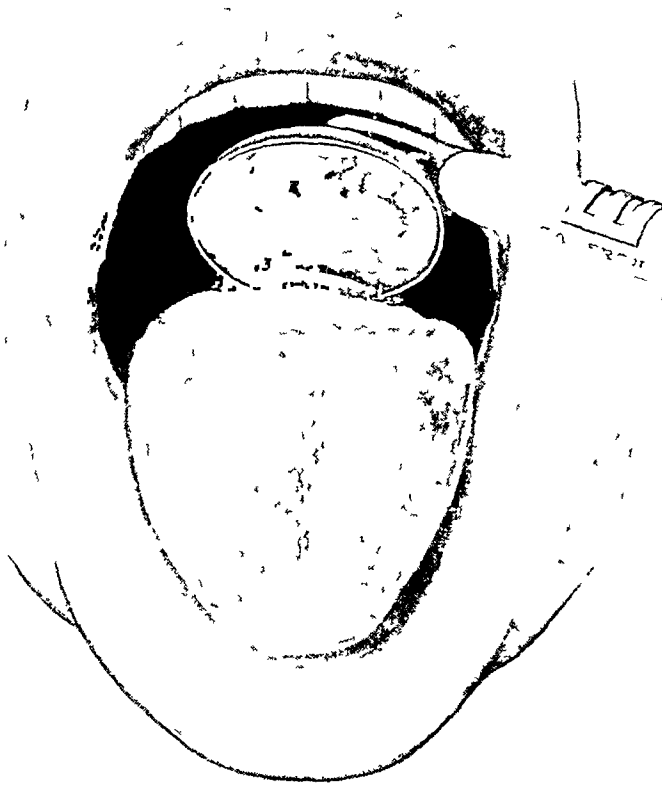


FIG 11—Carcinoma of the root of the tongue Here the malignant area is situated far back upon the posterior dorsal surface, a location where therapy of any sort is regarded as peculiarly difficult

posterior aspect of the tongue The broken line passing through Circle 2' represents the plane shown in (c)

Figure 7 shows implantation when it is considered desirable to apply longer centres of radioactivity as recommended by Regaud This type of applicator has the advantage of being entirely closed, making filtration absolutely complete, whereas the needles are open at both ends, thus never providing absolute complete filtration

In Figure 8 are set forth the various steps in the technic of implantation, illustrating the facility and exactness with which the radioactive centres can

RADON SEEDS IN CARCINOMA OF THE TONGUE

be placed. Attention is especially directed to the ease with which the seeds are removed after the desired period of radiation has elapsed.

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THE EXPERIMENTAL PRODUCTION OF DUODENAL ULCER BY EXCLUSION OF BILE FROM THE INTESTINE*

BY ROBERT KAPSINOW, M D

OF NEW HAVEN, CONN

THE etiology of chronic ulcer of the duodenum in man has long been a subject of much discussion. Anatomical and physiological studies have been carried on in detail and upon these findings many theories have been propounded. That these theories yet remain but hypotheses is suggestive of a paucity of conclusive evidence as to the etiological agent or agents.

In animals, and in particular in the herbivorous species, it has long been recognized that acute ulceration occurs under a variety of conditions, such as extreme malnutrition, profound intoxication and as a terminal event in many infectious processes. Chronic or even subacute ulcers, however, are not found with any degree of frequency and this is particularly true in dogs (Ivy¹). This animal is then a good subject for experimentation and much work has been done on the production of acute ulcers by utilizing dogs already diseased, as with distemper or mange or those in whom a generally diseased condition has been induced. In such animals trauma or the implantation of a virulent organism may produce a subacute or chronic ulceration (Rosenow²), (Ivy,^{1, 3, 4}), but this sequence of events rarely if ever corresponds to the development of the disease as seen in the clinic. In addition these manoeuvres introduce such a multiplicity of etiological agents that one may be still in doubt as to the precise cause of the ulceration.

More definite evidence has been submitted by Mann and Williamson⁵ who have been able to produce ulceration of that part of the intestine which is adjacent to the pylorus in a large proportion of their experiments. These involved the transplantation or excision of the duodenum, or the transplantation of the bile and pancreatic ducts, with or without the duodenum, into a portion of the intestine far away from the stomach. They conclude that when the secretions, normally present in the duodenum, are transferred to a point elsewhere in the intestine, that portion of the gut left exposed to the action of the gastric contents undergoes ulceration of a chronic type.

In a series of experiments concerning the functions of the bile a method, described in detail elsewhere,⁷ was devised for the exclusion of the bile from the intestine, in such a manner that infection of the ducts might be avoided and likewise any possibility of ingestion of even small portions of the bile. This consists essentially of an implantation of the fundus of the gall-bladder transcortically into the pelvis of the right kidney, thus establishing an anastomosis—a cholecysto-nephrostomy. At a later date, when healing

* From the Department of Surgery, School of Medicine, Yale University, New Haven, Conn.

EXPERIMENTAL PRODUCTION OF DUODENAL ULCER

is complete, the flow of bile is entirely diverted into the urinary tract by ligation and division of the common duct

It is obvious that this procedure can be carried out with no trauma to the intestine. The first stage is followed by the appearance of bile in the urine, but there is no loss of weight or impairment of the animal's health. Following the second stage—the relatively minor operation of ligation of the common duct—the picture changes. With the complete exclusion of bile from the intestine the animal loses weight, soon refuses the greater part of his food, the stools be-

come tarry, and if he is sacrificed or autopsied after an interval of two weeks or longer following the operation, one finds,

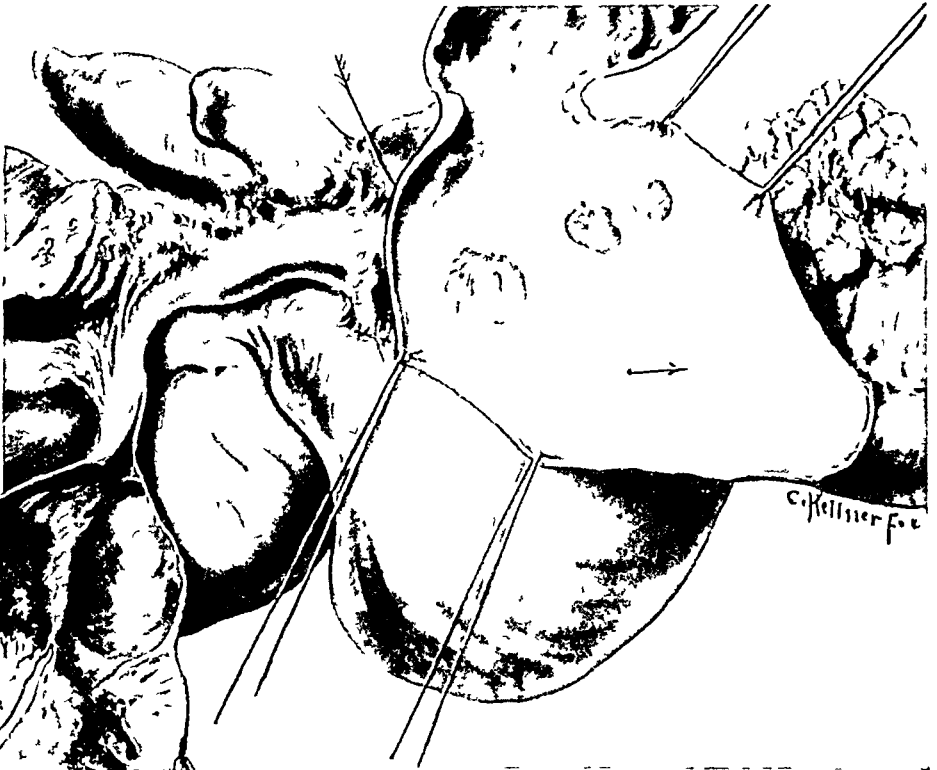


FIG. 1.—Showing gross appearance of ulcers *in situ* which were produced by cholecysto-nephrostomy and also by common duct obstruction

with great frequency described by Mann and typical duodenal ulcer

ulcers of the duodenum of the type that are Williamson. Of 43 animals, 17 developed typical

These appear singly or in multiple and are usually in the vicinity of the ampulla of Vater. They bear no relationship to the mesenteric border of the intestine. In size they vary from a minute ulceration to those measuring $1\frac{1}{2}$ to 2 cm in diameter. The defect has a punched-out appearance, the edges are overhanging and frequently the ulceration extends through to the serosa. In two instances there have been definite perforations. Microscopically, the appearance is that of the subacute or chronic peptic ulcer in man.

The formation of duodenal ulcers following gastro-enterostomy may represent an analogous procedure by which intestinal mucosa insufficiently protected by alkaline juices of the duodenum is exposed to the gastric contents, and Dodd and Linn⁶ in the course of the experimental formation of a

pouch from the antium pylori have encountered ulcers in the short-circuited duodenum

Such experiments have two factors which are open to criticism. Firstly, the animals are usually suffering from a considerable degree of malnutrition as a result of the extensive and deforming procedures carried out. Secondly, the intestine is subjected to direct and extensive trauma and the possibility of interference with its blood supply is always present.

If one could produce ulcer in the duodenum by an operative procedure not involving in any degree the intestinal wall and carried out upon animals

whose vitality was normal, then the evidence as to the importance or unimportance of these secretions might be fairly conclusive. There is, of course, no method of deflecting the secretion of the duodenum itself without subjecting the intestine to operative trauma. The pancreatic duct, as is well known from the experiments of Minkowski and



FIG. 2 — Typical ulcers produced

many others, may be ligated with no damage to the intestine, and no appreciable impairment of the animal's health. This procedure, however, does not produce chronic ulcer of the duodenum. Ligation of the common duct with the resulting obstructive jaundice leads rapidly to so severe an intoxication of the animal that any positive result which might be obtained would not be of any great significance. In the experimental biliary fistula of the customary type, that is, with a sinus leading from the skin to the gall-bladder and with the common duct ligated, such ulcers do occur (Whipple). The probability of infection of such a sinus and of an ascending infection of the hepatic ducts makes positive findings inconclusive, while the absence of ulceration might hypothetically at least be explained by the dog's ingestion of bile by licking the wound.

It would seem then, that such ulceration can be produced without trauma to the intestinal wall as a contributing factor and that they may be brought about in dogs not previously diseased. Whether these lesions precede or follow the nutritional disturbances incidental to the exclusion of the bile is not decided. It is at the present time unwise to enter into any hypothetical discussion as to the way in which the exclusion of the bile acts. It is well to keep in mind that the bile has other functions beside that of an ant-acid and

EXPERIMENTAL PRODUCTION OF DUODENAL ULCER

that the gastric secretion is not composed of hydrochloric acid alone. Further experimentation will be necessary in order to determine the details of the processes leading to the formation of these ulcers.

SUMMARY

Exclusion of bile from the intestine by a cholecysto-nephrostomy with



FIG. 3—Cross section of chronic ulcers demonstrating the punched-out overhanging edges

ligation of the common duct, frequently, leads to the formation of sub-acute and chronic ulcers in the duodenum.

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AIDS TO CHOLECYSTECTOMY*

BY CHARLES L. GIBSON, M.D.

OF NEW YORK, N. Y.

VARIOUS steps in the operation of cholecystectomy will be described which have given a technic which is a pleasure to the operator and a comfort to the patient. No claim for originality is made.

This success has been attained by paying particular attention to the following:

1. A good exposure by an incision which also allows of direct drainage if necessary, and minimizes the dangers of subsequent hernia.

2. The shelling out of the gall-bladder—"subserous excision"—from its peritoneal coat so that nowhere is the surface of the liver involved, that is, no hemorrhage or extravasation of bile results.

3. The sealing of the cystic duct by peritoneal blockade, this procedure with the subserous excision making possible the next step.

4. Closure of the wound without drainage in suitable cases, thus doing away with or minimizing the inevitable post-operative adhesions which often spoil the results of an otherwise good operation.

5. Better methods of hæmorrhage, particularly of the cystic artery.

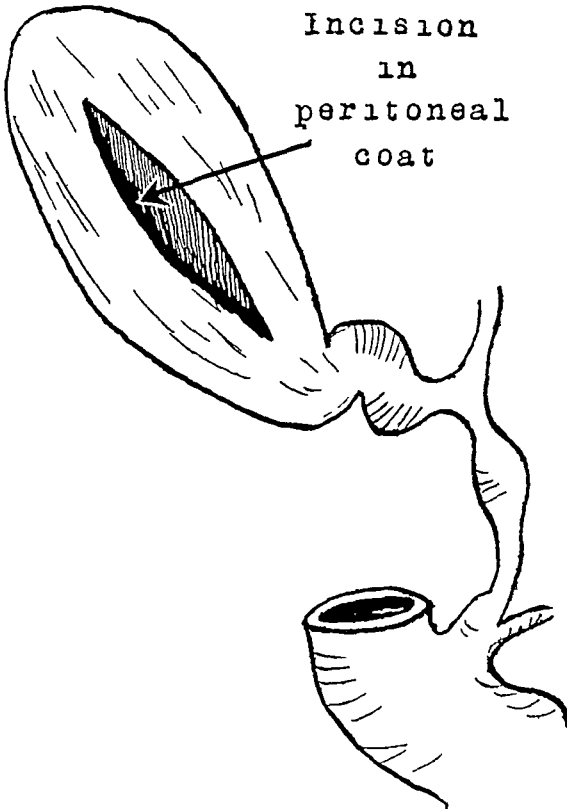


FIG. 1—Subserous excision of gall-bladder through peritoneal coat. Incision

Incision—Like all other operations, easy extirpation of the gall-bladder presupposes a good exposure. A good incision must allow of a good view of the triangle formed by the junction of the three ducts—cystic, hepatic, and common.

An incision most readily allowing of the pulling down and eversion of the liver with access to its under surface is desirable. In a thin patient with lax abdominal walls and general "floppiness" of the abdominal viscera, almost any kind of incision will do. With the obese—deep wound, and a liver that will not budge—we have a problem.

* Read before the New York Surgical Society, February 24, 1926.

Exposure of the liver may be obtained by several incisions 1 Straight, anywhere from the outer border of the rectus to the midline Modifying the straight incision into the form of a bayonet or letter "Z" 2 Right-angled, such as the Peirithes 3 Oblique, parallel to costal arch, generally known as Courvoisier

1 The *straight* incision generally suffices if it is long enough, but has the disadvantage if big enough, of giving rise to many post-operative herniæ (even with primary union) from destruction of the nerve supply The straight incision, if bordering on the midline, does not allow of the shortest path for a drain

2 *Right-angled* Perfectly good incision for the bad cases, if it is known that the procedure is to be complicated Its disadvantages are time consuming, cuts across the rectus, and disastrous if primary union is not obtained

3 The *Courvoisier* incision allows of (1) Better delivery of the liver (2) Direct drainage at any part of it that may be necessary (3) Runs parallel to the nerve fibres and both in theory and practice does not give rise to post-operative hernia

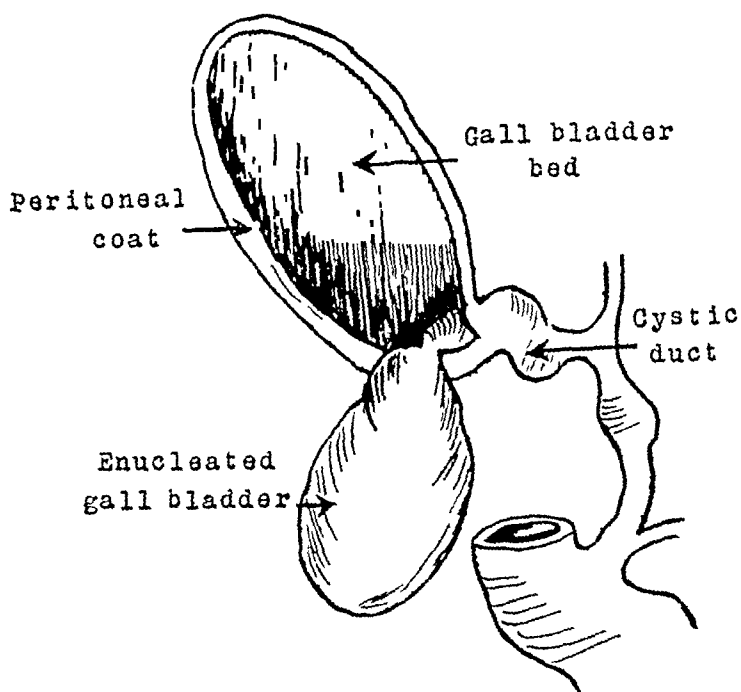


FIG 2 —Gall-bladder entirely freed from its peritoneal coat Hanging by its sole attachment, the cystic duct

The disadvantages, practical and theoretical, are (1) A little bloodier (2) A little harder to close (3) Does not lend itself so well to supplementary operations, such as appendectomy

This is the incision I used in my earlier work and to which I have returned as more nearly the ideal I use it, however, only when the diagnosis seems quite certain

If the gall-bladder is not friable it can be used to pull up the liver, giving a good exposure to the ducts The last step in the operation should be the removal of the gall-bladder and all the deeper work—hæmostasis and suturing—should be done while the gall-bladder remains attached to the liver

Hæmostasis—In the beautifully illustrated works on operative surgery, the cystic artery is an attractive vermilion colored structure, standing out prominently to the north of the cystic duct—a direct invitation to a ligature In practice "there ain't no such animal" There are some indefinite strands of tissue at the bottom of a deep dark hole These strands form an obstacle

to the lifting up of the gall-bladder after the cystic duct has been divided. One of these strands is the cystic artery.

Moral—Divide any and all of these strands only after a double ligature and on the central side, along the ligature, also place a clamp. Then cut between the ligatures and then tie the structure held by the clamp *again* and thus avoid a tragedy real or potential. Don't put on clamps and expect to tie later. The clamp pulls off and the cystic artery is loose. There will be sharp hemorrhage and common and hepatic ducts may be injured in a blind application of clamps and ligatures.

Removal of the Gall-bladder from Above or Below—Many of these operations are simple, that is, there is a good exposure of the dangerous triangle and the pathological changes have not materially obscured the normal anatomy. Under these conditions the routine procedure—dissecting off of the overlying fatty peritoneal layer from the ampulla to the common duct—gives a clear view of the cystic and other ducts and permits of the easiest procedure—retrograde cholecystectomy. The cystic duct is doubly ligated with catgut. The distal ligature is further reinforced by a clamp. Division with cautery for asepsis with a view to closure without drainage.

In the typical difficult cases there is a massive infiltration of the area of the dangerous triangle, sometimes calcareous, and there is no normal anatomy in sight. Any attempts at dissection causes diffuse bleeding and makes a hard situation harder, and offers dangerous possibilities of wounds to the hepatic and common ducts and other important structures. The procedure at its best is time consuming and the (generally) unfavorable subject is subjected to the prolonged deadly anæsthetic.

It is in these conditions that the subserous excision from above is a life-saver. To perform it properly presuppose keen knives and eyesight and a delicate touch.

The peritoneal coat from the fundus to the ampulla is incised, exposing the mucous membrane (Fig 1). When the right layer has been entered after patient dissection, the gall-bladder is easily shelled out of its bed as a pea out of a pod (Fig 2). Haberer's modification of the Kocher hollow sound (two sizes) greatly aids in the dissection (Fig 3).

Finally the gall-bladder has for its only attachment the readily visible and accessible cystic duct which is then readily ligated without possible harm to other structures and without hemorrhage.

The sealing of the cystic duct after ligature must be done by burying it in a fatty peritoneal bed, usually a structure adjacent to it. The temptation is strong to use one of the fatty tabs from the upper surface of the transverse

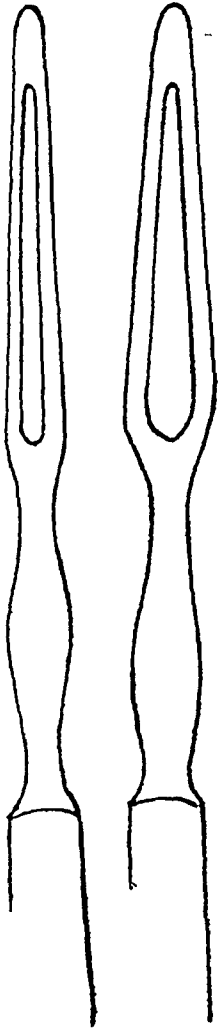


FIG 3 —Modified
Kocher Dissectors
(Two sizes)

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colon If this step can be carried out without compressing the duodenum by the displaced tab, all is well Next comes a similar structure from the gastro-hepatic omentum

In fat people either of these procedures are available In thin persons a suitable fatty flap may not be available without distortion or compression, and the procedure should be abandoned and the wound drained Failure to realize the disadvantages of this torsion tension resulted once in the leakage of the cystic duct necessitating secondary drainage with a prolonged convalescence

The last step is a running catgut suture closing the serous membrane from which the gall-bladder has been removed If drainage is employed some form, large or small, of my rubber dam Mikulicz † is the best It is easily removed, never allowing gauze to come in direct contact with the tissues

My cases closed without drainage have had short and comfortable convalescences, free from immediate discomfort and pulmonary manifestations, and the later results immeasurably better These results have contrasted with many nice cholecystectomies complicated by drainage who returned with many symptoms of disturbance due to adhesions Five times I have had to do a gastro-enterostomy following cholecystectomy with drainage where the obstruction to the duodenum could not be otherwise dealt with satisfactorily (All five of these cases have good end results) None of the closed cases has developed a hernia

† Gibson, C L The Rubber Dam Mikulicz Tampon ANNALS OF SURGERY, April, 1921, p 471

TUBERCULOSIS OF THE MESENTERIC LYMPH-GLANDS

BY JEROME R. HEAD, M.D.

OF CHICAGO, ILL.

FROM THE SURGICAL SERVICE OF THE WISCONSIN STATE GENERAL HOSPITAL

TUBERCULOSIS of the mesenteric lymph-glands—*tabes mesenterica*—has long been recognized as a clinical entity. Until the latter part of the 19th century it was a diagnosis frequently employed to cover a group of cases in children characterized by malnutrition, swelling of the abdomen, and frequent copious stools. The diagnosis was a clinical one and there were doubtless included within its scope many cases of tuberculous peritonitis, of rickets, and of simple malnutrition. With the advance in clinical discrimination the other conditions were weeded out and there emerged a varied clinical, but definite pathological entity which is sufficiently frequent to be of real importance.

The work on the subject has been done mostly by French and German authors. There have been numerous articles in the English and American literature but no one that is comprehensive. The result is that even to-day the condition is not generally understood in the diversity and seriousness of its clinical manifestations. This is attested to by an examination of the literature. Search through the principle American and English text-books has failed to afford a satisfactory discussion and in the corresponding periodicals I have been able to find no extensive collection of cases, although the articles of Corner^{3, 4} and Caisson² are excellent presentations of relatively numerous personal observations.

The largest series encountered is that of slightly less than 100 cases collected and reported by Floderus in 1912.

In view of these facts it seems worth while to report the following instance of one of the serious complications and by reference to more complete studies present a picture of the disease.

CASE I—Tuberculosis of mesenteric lymph-glands. Free perforation of a caseo-calcareous mass, operation. Excision of one gland, curettage and suture of another, appendectomy, recovery.

S. W. G. H., No. 179 R. L., a single male university student of twenty years, was brought to the hospital, March 31, 1925, complaining of severe abdominal pain.

The family history was negative. No history of tuberculosis. His past history was essentially negative with the exception of the fact that when ten years old he had scarlet fever and for several months afterwards had intermittently a slight evening rise in temperature and for a year was in a relatively poor health. From that time until the onset of the present illness he had been perfectly well, had developed normally and been robust and active.

His present illness dated from the evening of admission. While engaged in a game of water basketball he noted, towards the end of the game, vague abdominal pain, and more than usual shortness of breath. He had to call time out several times to recover. On arriving home he felt nauseated. The pain had been growing steadily worse and was now severe enough to make him double up and roll on the floor of his room. A

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physician was called who relieved the pain by giving morphine. He was brought immediately to the hospital. There were no other symptoms. The pain was general over the whole abdomen but worse on the right side, especially in the right lower quadrant.

Physical examination showed a remarkably well-developed and well-nourished young man lying on his back in bed with his knees flexed. He was apparently suffering considerably. Practically no abnormalities were found except in the abdominal examination. The abdomen was held tense and moved very little with respiration. It was tender throughout and there was definite spasticity of all the muscles. This was most marked on the right side and especially in the lower quadrant where the rigidity was board-like and the tenderness acute. There was rebound tenderness. No masses or fluid made out but the examination was unsatisfactory on account of the spasm. Temperature, 99, pulse, 84, respiration, 20, white blood-cells, 11,000. Diagnosis—acute appendicitis.

He was operated upon by Dr. A. S. Crawford shortly after admission.

Operative Note—McBurney muscle splitting incision. On opening the peritoneal cavity small pieces of material resembling cream cheese were found free in it. The appendix was found to be essentially normal. Exploration, after widening the incision, revealed a group of enlarged caseo-calcareous glands at the root of the mesentery of the small intestine. The omentum was adherent about them. The largest, about the size of a hen's egg, had ruptured and from it whitish, cheesy material was escaping. The remaining contents were scraped out and the cavity infolded with catgut sutures. One of the other glands was removed for diagnosis. Appendectomy was performed. Closure with drainage.

Culture from the peritoneal cavity showed no growth at the end of forty-eight hours.

Pathological Report—Caseo-calcareous tuberculous lymphadenitis.

With the exception of a mild attack of broncho-pneumonia he had an uneventful post-operative course and was discharged from the hospital on April 27, 1925. His wound was well healed. He was told to return regularly for continuation of ultra-violet treatments started while he was in the hospital.

Subsequent Course—The patient was perfectly well until September, 1925, five months after his discharge, when shortly after eating his noonday meal, he was taken with cramp-like pains in his epigastrium followed by nausea and vomiting. He continued with the nausea and vomiting and pain throughout the afternoon and evening. The next day he was well enough to go about his work.

He had another similar attack a short time later.

November 20, he had another attack, not related to eating, of cramp-like pains in the epigastrium, nausea and vomiting. This lasted for two days, finally forcing him to go to bed and lie with his legs drawn up. The third day he was sufficiently improved to be up and about. He has been well since. He maintains his weight.

X-ray Examination—November 25, 1925, gave the following findings: "Stomach and duodenum negative under the screen. Plates show antrum somewhat cut off. Cap incompletely filled without showing any defect. Twenty-four-hour plate shows marked spasticity of colon. Residue on the right and left side visualized in transverse colon as irregular line."

Discussion Definition—What term should be applied to the condition and what cases should be included within the category have been matters of discussion. Many of the earlier writers (Machtles-Floderus⁵) used the name "Primary Tuberculosis of the Mesenteric Lymph-glands," while Gehrels⁶ preferred the term "Surgical Tuberculosis." It is agreed by all that instance of involvement of the glands, secondary to acid-fast enteritis or in the presence of diffuse tuberculous peritonitis, should be excluded. The former term Gehrels holds, and I believe justly, to be too narrow, including as it does, only

those cases where the lesions in the mesenteric glands are the only ones demonstrable in the body. This definition is of interest from the etiological point of view rather than the clinical. Clinically all cases present the same picture and problems in which involvement of the glands is the sole abdominal lesion. The presence of other foci in the glands of the neck, in the lungs, or elsewhere is of secondary importance.

Etiology—The mode of infection is ingestion and the route is through the intestinal mucous membrane to the glands which drain it. The bacilli may be ingested either in the milk or milk products of tuberculous animals or, in persons suffering from pulmonary tuberculosis, may be swallowed in the sputum. In a high percentage of instances the organisms found are of the bovine type.

Whether or not the bacteria can pass through the bowel mucous membrane without producing a lesion is a matter of only academic importance, in view of the fact that in the cases here discussed, no evidence of intestinal involvement, even in those which came to autopsy, could be found. If there had been lesions they were microscopic and healed. In this connection it should be added that it is not unusual to encounter tuberculous cervical adenitis with no demonstrable disease in the tonsils or in the buccal or nasal mucous membrane.

Incidence—In 1912, Floderus was able to collect something less than 100 cases. This is a poor indication of its incidence for over one-half of these were reported (as occurring in their own experience) by three authors. Since then Carson² has published a series of fifty cases and Iselin³ one of eight of acute perforation, Kieler in 15,000 post-mortem examinations found the condition in one per cent. Bertzke presented similar figures. Osler and McCrae¹⁰ state that Bovaird at the Mt Sinai Hospital, New York, found the incidence at post-mortem as less than one per cent, while John Thomson reports it as 3.54 per cent for Edinburgh and 4.51 for Glasgow. It is probable that the condition is often latent, proceeding to a spontaneous cure without producing symptoms. It is certain that many cases are not diagnosed correctly. Among these are doubtless many of the instances of persistence of symptoms after operations for chronic appendicitis and also many of the cases of unexplained malnutrition in children.

Floderus found that two-thirds of the cases occurred in the first fifteen years. It was most frequent between the ages of five and ten. While these figures indicate that it is primarily a disease of childhood emphasis should be placed upon the fact that it is not infrequent in youths and adults. Gehrels calls attention to the fact that the surgical complications, especially ileus and perforation, are more frequent in young adults than in children. The case here presented is an example. Floderus found more boys affected than girls.

Pathology—The lymph-glands of the mesentery of the small intestine, numbering between one and two hundred, are arranged in three rows, the first composed of small glands lying close to the bowel—the second of ones slightly larger, lying farther out, and the third of still larger glands grouped

at the root of the mesentery. These latter receive the drainage from most of the large intestine as well as from the small.

In the mesentery of the large bowel the lymph-glands are much less numerous, numbering not more than twenty to thirty. The most important of these are the ileocaecal group which are subdivided into anterior and posterior and follow generally the course of the ileocaecal artery, the lymphatics from them emptying into the glands at the root of the mesentery of the small intestine. The glands of the rest of the large bowel drain similarly with the exception of those of the sigmoid from which the vessels pass directly to the lumbar retroperitoneal glands.

This outline of the anatomy is of considerable importance in a consideration of the pathology and of the symptomatology.

From the point of view of distribution of the lesions Gehrels divides them into two groups—the localized and the diffuse. The first (the most common) is characterized by the formation locally of large tumors—usually composed of numerous glands matted together, the second by a diffuse involvement of the glands over a large area. He says that the former type progresses less quickly to caseation and calcification and an arrested state. The second type, on the other hand, often represents a more virulent infection, is less easy to diagnose on account of the absence of a tumor, and the glands are more likely to undergo caseous and purulent degeneration. For this reason he considers it more dangerous than the other and more likely to lead to serious complications, especially to adhesions and ileus.

He quotes Payr as making the following classification: 1. Multiple small glands near small bowel. 2. Larger glands matted together near root of mesentery. 3. Tuberculous gland tumors of the ileocaecal region.

The ileocaecal glands are most frequently affected and for this reason the tumor is most often on the right side. In twenty-five instances Thieman found it on the left in only two. Pagenstecher says that the order of incidence is first ileocaecal glands, second, those at the root of the mesentery, third, those of the ascending colon, and fourth, those of the sigmoid. The glands at the root of the mesentery are of great importance, receiving as they do, the flow from most of the others. For this reason they are very frequently affected, and their location retroperitoneally and in close relationship to the blood supply of the bowel, makes them of great clinical significance.

The tuberculous lesions in the glands themselves are similar to those in glands in other locations. The finding at any certain time is dependent upon the stage of the process. The course is governed by the ratio between the virulence of the organism and the resistance of the individual. It has been suggested that in the mesenteric glands there is a greater tendency to calcification. The primary lesion is, of course, the tubercle. These tend to become conglomerate and produce swelling—simple hyperplasia. Probably in most instances, fibrosis, caseation, and calcification proceed hand in hand and the process is brought to a termination without the production of symptoms or of great enlargement. The hyperplasia may, however, become marked, caseation

may out-distance the process of repair, and large caseous tumors be formed. If the infection is virulent, or if secondary infection occurs, pus may be formed. In the clinical cases this is very common.

Of great importance is the extension of the process through the gland wall—the development of periadenitis. In some instances this process is gradual, and in others there is a sudden rupture of a purulent or caseous mass. In the former case there is produced a local peritonitis and adhesions. If numerous glands close together are involved they become matted together into a knotty tumor, adherent to surrounding viscera. This may produce complications. Sudden rupture of a purulent or caseous tumor is not uncommon. This may lead to a generalized tuberculous peritonitis, or if there is secondary infection, to an acute septic peritonitis (Rotch, Iselin and Floderus report such accidents).

From a clinical point of view the effect of the process upon the surrounding viscera is of great importance. The formation of kinks and bands has already been mentioned. When the glands at the root of the mesentery are involved there results often a lymphatic obstruction and a dilatation of the efferent lacteals. Enlargement of these glands may interfere seriously with the circulation of the bowel, in some instance even to the production of gangrene. Cases have been reported of obstruction by pressure of the common bile duct, of the ureter and of the pylorus and duodenum.

If pus formation is extensive, large cold abscesses may be formed. These, if in the mesentery, usually rupture into the bowel or bladder, or retroperitoneal, in the glands at the root of the mesentery, the pus will burrow and discharge as a psoas abscess or through Petit's triangle. Gehrels mentions one case in which an umbilical fistula developed.

Symptoms—There have been attempts to establish for the condition a typical clinical picture. These are misleading, for, while certain syndromes are more common than others, the disease is characterized by the variety of the ways in which it makes itself manifest, and it is this aspect of it which needs emphasis. How great this variety may be can be surmised if one considers the wide distribution of the mesenteric glands—any one of which or any group of which may be affected, and the great differences in the acuteness of the process as it is determined by the ratio between the virulence of the organism and the resistance of the individual.

The disease may be silent, progressing to healing or to an advanced stage with the production of no noticeable symptoms. In many instances it runs a chronic course, with or without acute exacerbations, over many years. On the other hand, the first symptoms may be so acute as to lead to immediate operation, or they may be those of one of the late complications, ileus, perforation, or pressure upon the common bile duct, duodenum or pylorus. In the series reported by Floderus the average duration was three months, the longest—years and the shortest, of course, only a few hours. In a series of fifty cases, Carson found the mean duration to be seven to eight months, the longest thirteen years, the shortest similarly a few hours.

Occasionally the onset of the disease is determined by some acute infectious process. The present case and that reported by Melman¹¹ are examples. In both there was persistence of temperature after the attack of scarlet fever in the first instance and influenza in the second.

In the chronic cases, the initial and presenting symptom is most often pain. This is usually intermittent. It may be vague and transitory or relatively sharp and colicky and more persistent. It is often drawing and dragging. It rarely has any relation to any of the bodily functions. It may be located in any part of the abdomen, the location being determined by the particular gland or gland group involved. Because the ileocaecal glands are most often affected, it is most often in the right lower quadrant. It may be in the right upper quadrant from involvement of the glands of the ascending colon, or in the epigastrium¹⁰ from those in the transverse mesocolon or over the pancreas. Rarely it is on the left side. In many instances (probably in connection with disease of the glands at the root of the mesentery) it is referred to the region of the navel. In this connection the Germans have described a more or less typical "Nabelschmerz" seen most often in children. Carson¹² describes it as follows:

"It is a sudden centralized abdominal pain, severe enough to make the child cry, lasting about five minutes or less, relieved by pressure and hot applications, recurring perhaps two or three times a day and stopping as suddenly as it began, so that in the intervals the patient is quite free. In some cases pain occurs every day, in others only at intervals of a month or so, the attack lasting two days. Vomiting occurred at the time of the pain in thirteen of the typical cases." Carson attributes the pain to a reflex colic incited by irritation of the vagus filaments in the mesentery. This may be so. It is certain that in some instances it is associated with meteorism and is typical of that caused by adhesions. The acute exacerbations may be caused either by secondary infection with pyogenic organisms, or by the penetration of the infection through the gland wall with the instigation of a local peritonitis. The acute symptoms of free perforation will be discussed later.

A chronic course of this nature is very often punctuated with acute exacerbations. These simulate in practically every respect attacks of intraperitoneal inflammation due to other conditions. There is increase in pain which is persistent and steady. There is often vomiting and the temperature and leucocyte count are elevated and the affected part of the abdomen is tender and spastic. The symptoms may be very severe.

Only occasionally, says Gehrels, are the presenting symptoms loss of weight, appetite, and strength—many of the patients are well nourished and robust. In a certain percentage the general nutrition is affected and in silent cases this may be sufficiently marked, especially if associated with slight rises in temperature, to lead to the suspicion of and search for a latent tuberculous focus.

There may be periods of slight daily rise in temperature. During the acute attacks it is always elevated and may rise to 40 degrees C. Milian¹³

tuberculosis complicates the condition more frequently than any other and a persistent high fever may indicate the development of this complication

For the older clinicians the nature of the stools was one of the characteristic findings. These were described as frequent, foul smelling, thin, voluminous, light, shiny, and rich in fat. In many of the reported cases they were of this nature, but the symptom was far from constant and functional constipation or chronic mechanical obstruction are not uncommon. The thin voluminous fatty stools are doubtless the result of the lymphatic obstruction and the consequent hindered absorption of fat.

The chief dangers of the condition lie in its complications. Of these ileus, free perforation, abscess formation, pressure on other organs, and miliary tuberculosis are the most common. Hemorrhage has been reported and also mesenteric thrombosis.


As has been noted earlier acute ileus may be the first symptom. Homuth⁸ has reported one such instance and Bruning¹ two. Ileus was met with ten times in a series of fifty-three cases reported by Prutz. There were seven cases in the fifty reported by Cason. Of these three were caused by intussusception. Often there are symptoms of chronic obstruction for a longer or shorter period before the acute onset. These are obstipation and recurrent attacks of meteorism accompanied by clamp-like pains. Vomiting may occur with the attacks. The causes of the obstruction have been discussed under the pathology and the symptoms and treatment are too well known to require description.

Gradual extension of the process through the gland surface may produce a generalized tuberculous peritonitis. More often the peritoneal infection is local, the inception of this doubtless accounting for some of the acute exacerbations, and the resultant adhesions for the late ileus.

When abscesses form, if they are of the typical "cold" variety, the symptoms may be relatively slight. If the process is acute or there is secondary infection, there may be high temperature, pain, spasm, tenderness and tumor. In many of the cases operated upon during an acute exacerbation there was found a conglomerate mass of caseous and purulent glands. The acute symptoms may terminate abruptly on the rupture of the abscess into the bowel, bladder or stomach. Iselin has reported one instance of spontaneous drainage *via* the umbilicus.

Acute and free perforation presents a much more striking picture. It is that typical of perforation peritonitis. There is the sudden onset of severe knife-like pain followed by vomiting and collapse. In two instances trauma seems to have caused the rupture. Examination shows the abdomen board-like and exquisitely tender. Rebound tenderness is marked. Of such an occurrence the present case is an excellent example. The outcome of it depends upon the type of gland which has ruptured. If it is an acute tuberculous process a general infection of the peritoneum may result. If there is secondary infection the peritonitis may be septic. Rotch reported one such case in an infant of eighteen months. If the ruptured gland is of the far-advanced

TUBERCULOSIS OF MESENTERIC LYMPH-GLANDS

 caseo-calcareous type, there may be produced nothing more than the inflammation of sterile irritation. In such cases the gland has become what might be termed a tuberculous cyst and it is this type that may be broken by trauma.

Hepburn⁷ has reported three cases and Valentine¹⁵ one of hydronephrosis produced by pressure of caseous or calcareous glands upon the ureter.

In Floderus' series there was one instance of painless and persistent jaundice from pressure upon the common bile duct, another of ascites secondary to obstruction of the portal vein.

Physical Findings—The patient may present the pallor and general poor nourishment typical of tuberculosis. Equally as often, or more often, he will be well-developed, robust and apparently in the best of health.

There may be evidence of other tuberculous foci, enlarged cervical glands, scars in the neck, tracheobronchial lymphadenitis, or signs of a latent or active pulmonary lesion.

The findings on abdominal examination will depend upon the nature and acuteness of the process. In the chronic cases there may be nothing but deep tenderness. During acute exacerbations or perforation there will be spasm and acute localized tenderness. In the clinical cases tumor is a relatively constant finding. In Floderus' series it was absent in only eight. The size may vary from one just large enough to be palpable to a tumor as large or larger than a man's fist. It is usually tender and slightly movable, but can be felt to be attached posteriorly. It is most often on the right side of the abdomen, especially in the right lower quadrant, but may be any place. They have been mistaken for appendiceal abscess, floating kidney, gall-bladder, cyst of the pancreas, in fact almost every variety of abdominal tumor. Rectal or vaginal examination may disclose a mass not palpable through the abdominal wall. The leucocyte count will vary with the acuteness of the process. Unless there is secondary infection it will be that typical of tuberculosis.

The temperature and stools have been discussed under the symptomatology. The von Pirquet test will be positive in infants and children, a finding of considerable value.

Diagnosis—A correct pre-operative or ante-mortem diagnosis is unusual. In Floderus' series it was made only seven times. The condition may simulate almost any acute or chronic intra-abdominal disease. That most frequently simulated is chronic or acute appendicitis. This is accounted for by the fact that the ileocecal glands are most commonly affected. It is probable that this is the pathology in a certain number of persons who are not relieved following operations for chronic appendicitis. Pavy cites as differential points the frequent absence of vomiting and the location of the point of tenderness between McBurney's point and the umbilicus.

The pain may mimic very closely that caused by renal colic, gall-bladder disease, or gastric or duodenal ulcer. Acute exacerbations in glands in the region of the sigmoid are most often mistaken for diverticulitis. Other conditions for which it has been mistaken are intestinal colic, obstipation, foreign

body in the bowel, intestinal and peritoneal tuberculosis, adhesions and ileo-cæcal tuberculosis

Treatment—Treatment may be either medical or medical and surgical. The former consists in rest out of doors, tonics, forced nourishment and ultra-violet therapy. X-ray treatment may be used. Floderus is responsible for the statement that the clinical cases do not do well under this régime. Especially is this so where the condition has advanced to a stage where accurate diagnosis is possible, when the glands are large and a tumor is palpable. It is his opinion, and that of most others who have written upon the subject, that such cases should be subjected to operation. In actual practice in most instances the diagnosis is not made until the abdomen has been opened. The difficulty in diagnosis thus illustrated is a further argument in favor of exploration.

The procedure at operation must, of course, be determined by the nature of the pathology encountered. The following methods have been used:

- a* Simple exploration
- b* Enucleation of the affected glands
- c* Enucleation of the affected glands combined with resection of the dependent piece of bowel
- d* Opening and curetting and packing with iodoform gauze and infolding with suture caseo-calcareous gland masses
- e* Drainage of abscesses

It has been suggested that simple laparotomy was beneficial in the same way that it was one time supposed to be for tuberculous peritonitis. There is little reason to believe this possible, and practically no clinical evidence to support it.

Where it is possible, enucleation of the affected glands, or at least the largest of them, is the method of choice. In doing this there is always danger of injuring mesenteric vessels that are essential to the vitality of the bowel and this danger is especially marked when the glands are at the mesenteric root. Because of the involvement of the vessels in the process, it is sometimes necessary to resect the corresponding segment of bowel. In such instances the abdomen can be closed without drainage.

In case the involvement is too extensive to permit of enucleation or enucleation and resection, caseous or caseo-calcareous glands can be opened, emptied and curetted and then either swabbed out with iodine and infolded by suture or the cavity packed with iodoform gauze.

In case of abscess formation, drainage with extirpation of all glandular tissue possible is, of course, indicated.

After acute perforation, if the gland ruptured was of the caseous type, closure without drainage is permissible.

The treatment of ileus and the other complications is too well known to require discussion.

Operation should be followed by a prolonged course of medical and general hygienic treatment and by careful and frequent observation.

TUBERCULOSIS OF MESENTERIC LYMPH-GLANDS

Results—The following statistics have been tabulated from a series of 78 unselected cases

Post-operative deaths	8
Operated too recently to be of value	6
Total cases followed more than six months	50
Well from six months to ten years	32
Nearly well	10
Died of the disease	2
Died of other diseases	2
Died of military tuberculosis	3
Recurrence and re-operation after nine years	1

SUMMARY

1 A case is reported of rupture of a caseo-calcareous tuberculous gland of the mesentery and a survey of the literature is presented

2 The term "Surgical Tuberculosis of the mesenteric lymph-glands" is preferred to "Primary Tuberculosis" in order to include within the category all instances in which the lesions in the glands are the only ones in the abdominal cavity

3 In Floderus' series two-thirds of the cases occurred between the fifth and tenth years. It may occur in infants and is not uncommon in youths and adults. The serious complications, especially ileus and perforation, are more likely to occur in the older patients

4 The mode of infection is ingestion and the route is through the intestinal mucous membrane to the glands that drain it. In a majority of cases the bacilli are of the bovine type

5 The pathology is that of tuberculosis in glands in other locations. In general there are two types—the diffuse and the localized. Many of the symptoms and complications are secondary to periadenitis and adhesions or to chronic or acute perforation of purulent or caseous glands. These may be secondarily infected

6 While certain syndromes are more common than others, the disease is characterized by the diversity of its clinical manifestations. There may be no symptoms, the picture may be one of chronic abdominal pain, with or without acute exacerbations. The first symptoms may be acute, due either to an exacerbation of a latent process or to one of the complications

7 The physical findings are as follows

- (a) There may be poor nourishment and development, but as often as not the patients are in good physical condition
- (b) There may be another tuberculous focus in this body
- (c) In most instances there is an abdominal tumor. This may be located in any part of the abdomen. In a majority it is in the right lower quadrant
- (d) During the acute exacerbations there is a tenderness and spasm
- (e) The stools may be foul, copious, shiny and rich in fat

8 Ileus, abscess formation, chronic or acute perforation, and pressure upon the duodenum, the common bile duct, the ureter, or the portal vein, and miliary tuberculosis are the chief serious complications

9 The diagnosis is difficult and is rarely made prior to operation. The condition most often simulated is chronic or acute appendicitis, but the symptoms may suggest almost any abdominal condition. The X-ray will show calcification if present and in children a positive von Pirquet reaction is of value.

10 The treatment is medical and surgical. The former is the same as for surgical tuberculosis in the other regions. The operative procedure indicated will be determined by the stage of process.

- 1 Extirpation of glands where possible
- 2 Extirpation of glands and resection of the bowel where injury to the mesenteric arteries is unavoidable or where there is gangrene
- 3 Drainages of abscesses
- 4 Opening and curettage of caseo-calcareous masses with subsequent packing or infolding suture

11 In 78 cases there were 8 post-operative deaths. Two of these were complicated by ileus and 2 by rupture of a secondarily infected gland. Of the remaining 70, fifty were followed "longer" than 6 months. Of these 32 were well, 10 nearly well—1 required re-operation after 9 years, 2 had died of other diseases, 2 of the disease itself and 3 of miliary tuberculosis.

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PYELOGRAPHY IN THE DIAGNOSIS OF TUMORS OF THE FLANK

BY FREDERICK C HERRICK, M D

OF CLEVELAND, OHIO

FROM THE SURGICAL SERVICE OF THE CHARITY HOSPITAL

TUMOR masses occurring in the flank, *i e*, that area bounded by the ribs, iliac crest and linea semilunaris, often present many difficulties of diagnosis. Indirect surgical approach or two incisions are the results of error. This discussion does not deal with the simple acute gall-bladder mass or appendiceal abscess, but with those flank masses of unusual origin or course. The determination as to whether they are intra- or retro-peritoneal, the type of disease and the degree of tissue destruction determine in a measure the nature and extent of proposed treatment. Symptoms and clinical signs are too often inconclusive, inaccurate and require a line of deduction not justified by the observations.

We are driven to seek the absolute evidence, for even to-day an exploratory operation is too frequent, when more definite methods of diagnosis would save the patient two incisions and some operative shock. In the following we wish to show the value of a properly taken and properly interpreted pyelography.

To illustrate, pyelitis and cholecystitis in women past middle life frequently co-exist and are the source of error as to the cause of acute abdominal symptoms.

We have seen the combination of a Riedel's lobe, a ptosed liver, an enlarged gall-bladder and the whole walled off by a mass of omentum, filling the right flank and associated with signs of acute renal infection when the diagnosis between the two conditions could be reached only by a careful cystoscopy and a pyelography. The mass could be an acute pyonephrosis upon a long-standing renal pelvic dilation, a subrenal abscess or an acute empyema of the gall-bladder, an intraperitoneal tumor of other origin, or a retroperitoneal tumor or abscess, or a misplaced or pyonephrotic ectopic kidney.

A simple pyelography in such a case may show a normal renal pelvis, thus excluding intrarenal disease in the presence of a mass large enough to be palpated and yet it is not conclusive, since it gives no positive evidence regarding the relation of the palpated mass to the kidney. The history, clinical signs and results of general and local physical examination may be inconclusive so that one resorts to the urologist for special evidence. He should have had a thorough general surgical training from which he must have retained a knowledge of abdominal surgical problems. In such cases we have placed a coin over the tumor on the surface and taken a pyelography. The direction of the ray and the relative distances of the kidney and mass from the plate must be considered.

PYELOGRAPHY IN TUMORS OF THE FLANK

With the aim of analyzing the value of pyelography in these cases we have divided them into three groups

- 1 Differentiations of intraperitoneal from retroperitoneal masses (perirenal, subrenal and renal)
- 2 Extra renal (retroperitoneal) from intra renal masses
- 3 Intra renal masses

In making these differentiations we have used six factors as observed in the X-ray from which to draw our conclusions

1 The position of the kidney, the normal being with its pelvis opposite the first or second lumbar intervertebral spaces. Variation from this must be explained by hypermobility due to one of the known causes or displacement by being pushed by tumor masses or drawn, *e g*, by inflammatory processes

2 Disturbance of the normal longitudinal renal axis. This is accepted (Kelly and Burnam) as obliquing toward the spine cephalad, at an angle of 15°

3 Disturbance of the normal antero-posterior axis or rotation of the kidney on its vessels as an axis (Blaasch)

4 Distortion of one or more calyces of the pelvis, typically seen as caused by pressure on the kidney from an extra renal mass. The entire pelvis and calyces are present but elongated or distorted by pressure

5 Absence of a part or all of one or more calyces. This, in our experience has been brought about more commonly by intra renal masses, abscess or tumor, by which a calyx has been destroyed or obliterated by pressure, so that the solution does not enter it

6 Fragmentation of the pelvis or calyces which constitutes a typical picture of tumor close to the true renal pelvis

The above three locations of tumor masses with their pyelographic diagnosis are illustrated by the following cases

I

An intraperitoneal tumor mass entirely separate from the kidney and adrenal can be differentiated from the kidney by placing a coin on the abdomen over it and making a pyelography

CASE I—*Acute Cholecystitis vs Kidney*—(No 2075) Female, fifty-six years old. No previous illnesses. Four days before seen, she began to have slight pain in the right hypochondrium, which became worse and colicky in character and was not referred. Nausea and vomiting. She had had a similar attack eight years before.

Examination—Fairly well nourished woman, of good color. No jaundice. Abdomen showed a full, rounded body on the right side, extending two inches below the level of the navel, descending on inspiration, movable laterally, not tender and extending back to the right kidney region and filling the flank on bimanual palpation. The urine contained pus and albumin two plus. Cystoscopy showed no accessory ureteral openings and a pure culture of colon bacilli. Pelvic examination showed the uterus and adnexa normal. Pyelography—Fig 1

In making the pyelography two coins were placed over the palpated mass and a pyelography taken. The outline of the kidney was clearly seen, its pelvis was normal

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while the coin shadows were shown to be lateral to the kidney and over the palpated mass. The tumor was therefore independent of the kidney.

Conclusion—Tumor of gall-bladder origin

At operation by the abdominal route an enormously distended gall-bladder with a Reidel's lobe and omental mass was found. Cholecystectomy. Recovery.

CASE II—*Acute Cholecystitis with Gall-stones vs Kidney*—(No 2148) Female, thirty-four years old. Examined for Doctor Hamann. Patient had had her appendix



FIG 1—Coin placed over palpable tumor (gall-bladder). Normal pyelography.

removed ten years previously. Four weeks before seen and four weeks after childbirth, she had a severe pain in the right lower quadrant of the abdomen originating in the same region as the old appendix, pain of a dull character which continued to the present.

Examination—Poorly nourished, slender, anæmic woman. Abdomen slightly irregular, showing a very tender mass in the right iliac fossa and extending upwards filling the right flank. The mass did not descend on inspiration. There was tympany between it and the costal border. It was not movable. The abdominal wall was atrophic in type, no muscular rigidity. Temperature 101°, white blood-cells eighteen thousand. The urine

PYELOGRAPHY IN TUMORS OF THE FLANK

contained albumin and pus one plus Because of its filling the right flank as felt by bimanual palpation, the mass was thought to be of kidney origin

Cystoscopy—Catheters passed easily to both kidneys Clear urine was obtained from both with negative cultures P S P appeared on the right side in three minutes and on the left side in three and a half minutes An X-ray with probes and a coin outlining the tumor as felt on the surface showed the kidney to be separate from the mass palpated It however showed the ureter apparently pushed over towards the spleen by the mass This has been noted in several cases in retroperitoneal, subrenal masses and

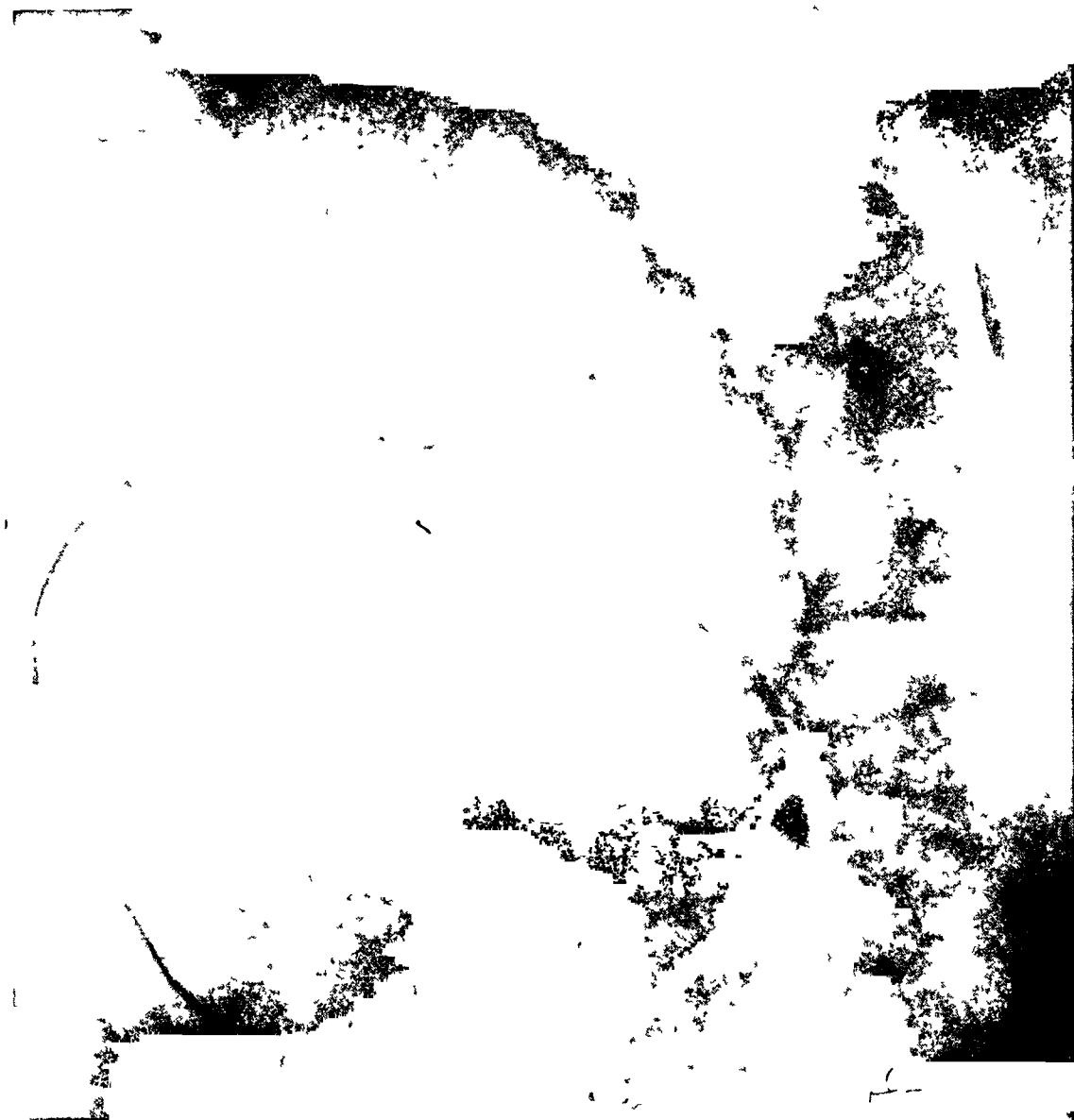


FIG 2 —Coin over palpable tumor (gall-bladder) Probes outlining the same

a diagnosis of retroperitoneal tumor was therefore made (Fig 2 without pyelography Fig 3 with pyelography) In this case the mass was so large and was lateral to the colon, so that the latter being pushed towards the middle line carried the ureter with it

Pre-operative Diagnosis—Retro-peritoneal tumor in the right iliac fossa Operation by the abdominal route, showed an enormously distended gall-bladder walled off by omental adhesions, and partly covered by a Reidel's lobe In this case the fixation of the tumor mass, presence of tympany between it and the liver, and the pushing of the ureter to the middle line led to the error in diagnosis, but that the mass was free from the kidney was certain

II

A retroperitoneal tumor above or below the kidney may be likewise differentiated and further so by the fact that a displacement of the ureter or kidney by the tumor is often present

The ureter may be seen to curve over the surface of the tumor and pushed toward the spine by an abscess or outward from its normal position by, *e g*, a retroperitoneal sarcoma In the foregoing hæmaturia will not be a constant factor, although its occur-



FIG 3 —Same with pyelography A slightly dilated pelvis and calyces due to pushing of the ureter to the left with partial obstruction and a chronic pyelitis

rence at one or more separated intervals may be due to a temporary venous engorgement Pain occurrence is variable and of variable character The cystoscopic findings are inconclusive or confusing in that a pyuria with positive cultures may be present

CASE III—*Appendiceal Abscess vs Kidney*—(No 2227), Fig 4 Male, thirty-five years old

P I—Two years before seen he was taken with an attack of severe pain in the right flank The pain was dull, aching in character and was referred along the genito-

PYELOGRAPHY IN TUMORS OF THE FLANK

urinary tract to the bladder *Marked increased frequency of miction—pyuria* There was no vomiting He had two such attacks of pain within three months of each other

On X-ray, in other hands, a shadow interpreted as a stone was seen in the right kidney He was operated, the kidney being split but no stone was found Following operation he had two more attacks of pain and was then first seen by the writer with his fifth attack He had chills, a temperature of 102° , *marked increased frequency of*

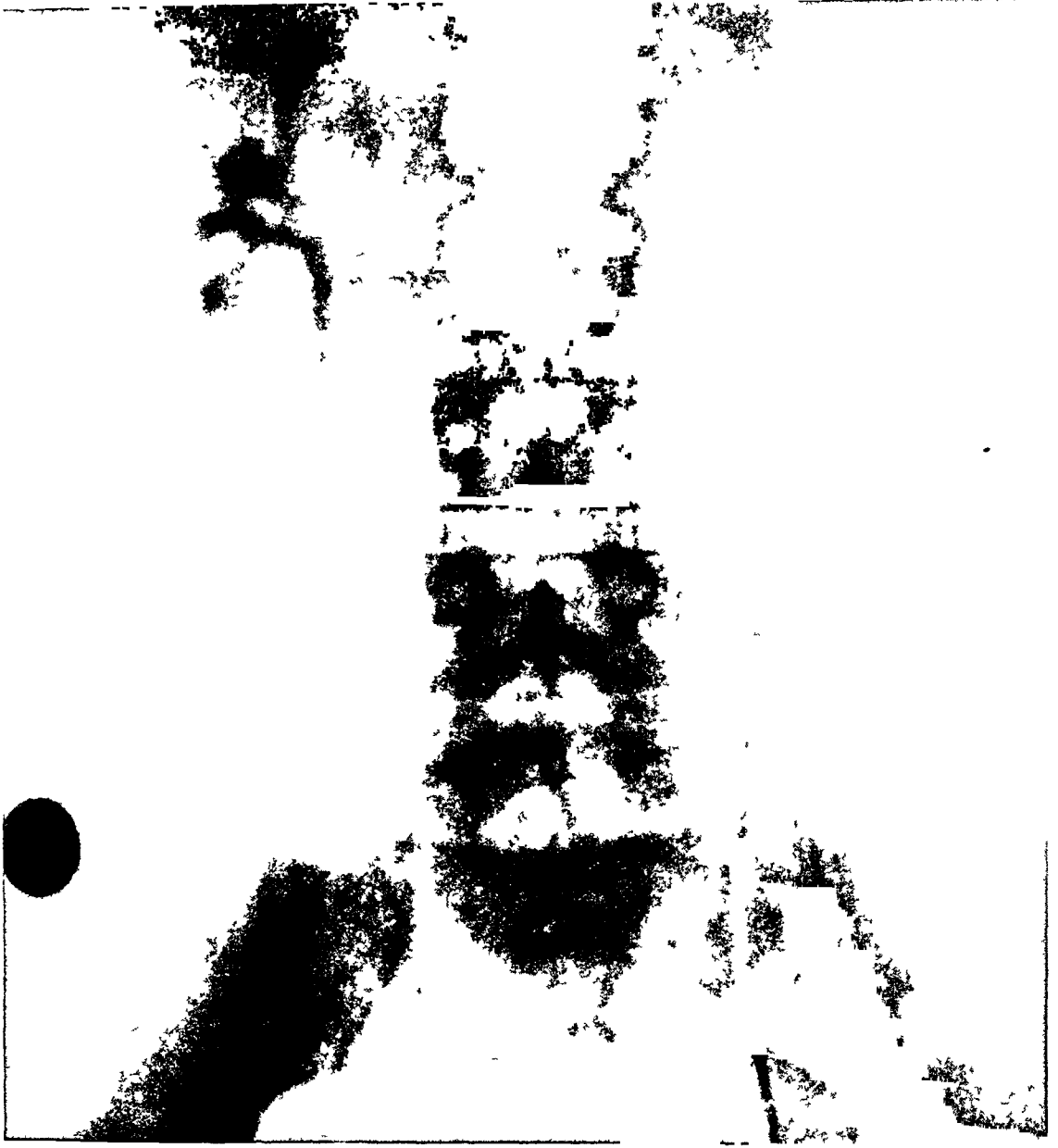


FIG 4—Coin over palpable mass movable appendiceal abscess with pyelography showing a normal pelvis *miction* and pyuria Examination showed marked rigidity of the entire right abdomen No tenderness over McBurney's point nor the lower abdomen White blood-cells—eighteen thousand

On palpating the right flank, a body was felt descending on inspiration like a low kidney and could be distinguished by palpation from the kidney Gross percussion posteriorly showed very marked tenderness over the right kidney The urine contained albumin and pus, two plus

The patient was watched for several days until the urinary output was increased and his temperature subsided

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Cystoscopy showed a normal bladder and normal ureteral openings. A pyelography with a coin over the mass showed it to be below the right kidney. The kidney was high, could not be palpated, and showed a normal pelvis.

Diagnosis—A chronic appendicitis. Retro-colic, retro-peritoneal abscess. Operation, appendectomy, drainage, recovery.

The occurrence of pyuria, at times hæmaturia and of pain referred along



FIG. 5.—Pyelography—kidney lying with its long axis antero-posterior from the subrenal mass ureter pushed to the left

the urinary tract has been frequently noted in appendicitis. These symptoms are of course due to the proximity of the appendicitis to the ureter, the extension of the inflammatory process to it and the reference of the pain partly by ureteral obstruction, due to swelling and pressure, producing renal colic and partly by cutaneous hyperæsthesia confused with the tenderness at McBurney's point. In this connection the reference of pain from such

disease to the right hip-joint might be mentioned. The genitocrural nerve, lying upon the psoas muscle, sends a branch to the hip-joint. Hence the occurrence at times of severe hip-joint pain both in appendicitis, ueteritis and other inflammatory processes of the urinary tract. Such cases could be cited.

CASE IV—*Subrenal Abscess*—(No 2226), Fig 5. Female, twenty-two years old. The patient was delivered of a badly macerated child at full term by Cesarean section.



FIG 6—Normal pelvis, subrenal abscess of long duration

Very marked colon infection of the uterus present. She progressed well until the seventeenth day, when she had a severe chill, temperature one hundred and three to four, with pain in the right flank, where a mass developed not distinguishable from the liver above, and extending two fingers below the navel, nearly to the midline, markedly tender, somewhat irregular and moved slowly forward on deep inspiration. No increased frequency of urination. Few white blood-cells and pus cells in urine. No hæmaturia. No attacks of colic.

Examination—Showed the above-described mass. The urine contained albumin double plus, but this was present before childbirth. Blood-pressure 118-80. Right kidney

on palpation was not tender Obviously a perirenal or subrenal abscess was considered An intraperitoneal mass, an ectopic infected kidney could not be excluded without special examination

Cystoscopy showed a normal bladder and ureteral orifices Number seven catheters were passed easily to both kidneys P S P appeared on the right side in five minutes, on the left side in nine minutes The urine from the left side was paler in color than



FIG 7—Normal pyelography ruling out renal tumor the ureter displaced away from the spine at its upper end by the tumor

that from the right, but both were clear amber There appeared to be no disturbance of the kidneys, except the delayed P S P

Pyelography showed the right kidney turned so that the axis was antero-posterior Its pelvis was not dilated The ureter appeared curved around the mass in the right flank This mass was seen below the kidney, with a faint interval between the two

Diagnosis—Subrenal abscess Drainage, recovery This case illustrates rotation of the kidney on its antero-posterior axis

CASE V—*Subrenal Abscess (Appendiceal)*—(No 2296), Fig, 6 Mafe, twenty-eight years old No previous illnesses Admitted complaining of pain in the right flank

PYELOGRAPHY IN TUMORS OF THE FLANK

extending down the groin towards the bladder and occasionally down the lateral side of thigh. The pain was of six weeks' duration, more severe in the past twelve days. Onset with vomiting. Active flexion of the thigh increased the pain. There was burning on urination and increased frequency five to six times a night. Patient was having night sweats. Abdomen showed marked rigidity on the right side and marked tenderness in the right flank. An indefinite mass was palpable. The kidney could not be felt. Urine showed specific gravity 1007, some pus, albumin one plus present.

Cystoscopy showed the bladder with moderate congestion. Number seven catheters were passed up both ureters easily and the functional test from the two sides was equal. A pyelography showed a mass below the kidney raising the kidney up to the spaces between the eleventh and twelfth dorsal vertebra two spaces high. The kidney was rotated on its axis antero-posteriorly. The lower calyx was elongated and partially obliterated by pressure from below.

Diagnosis of subrenal abscess was made, which was probably secondary to an appendicitis. Operation resulted in the drainage of the abscess, and although it extended down to the right fossa, the appendix could not be located extraperitoneally.

CASE VI—*Retroperitoneal Sarcoma vs Kidney*—(No 2297), Fig 7. Male, thirty-three years old. Complaining of pain across the upper lumbar region and down both flanks and groins, worse on the left side, constant, seven weeks' duration, no colics. There had been night sweats with some productive cough. For the preceding two or three years he had noticed some lameness of the lumbar muscles and he had lost forty pounds in weight. There were no symptoms referable to the gastro-intestinal, cardiac, respiratory, neurological, nor skeletal systems. Urinary frequency was slightly increased.

Examination showed a well nourished, large framed man. Neck, small right goitre, inactive, supraclavicular glands on the left side the size of a hazlenut, not tender, firm and movable. Chest negative. Abdomen scaphoid, flanks equal, muscles relaxed. Liver not palpable. Spleen enlarged, just palpable, round edge. Left kidney palpable on inspiration somewhat tender, and a mass the size of an orange mesial to its lower pole but undistinguishable from it could be felt. This descended on inspiration with the kidney and was somewhat tender. Genital and rectal examinations negative. The laboratory findings showed urine specific gravity 1013, albumin a trace, no sugar, a few hyaline casts, pus cells, no blood.

Blood White blood-cells, 10,700, hæmoglobin, 70 per cent. Differential count. Polymorphonuclears, 74 per cent, small mononuclears, 18 per cent, large mononuclears, 3 per cent, eosinophiles, 4 per cent, transitionals, 1 per cent, urea nitrogen, 23.8, uric acid, 3.4, creatinine, 2.73, mgm per 100 c.c., Wassermann negative. P. S. P. 55 per cent in three hours. The differentiation of this mass from the kidney was necessary.

Cystoscopy showed a normal bladder, an equal kidney function, negative cultures, and normal morphological elements. Pyelography showed a pushing of the left ureter away from its normal position outward, a normal left pelvis, a high left kidney and a normal position of the right ureter and kidney.

Diagnosis—Retroperitoneal sarcoma. Exploratory operation on request revealed a small round-celled retroperitoneal sarcoma. The supraclavicular gland showed the same

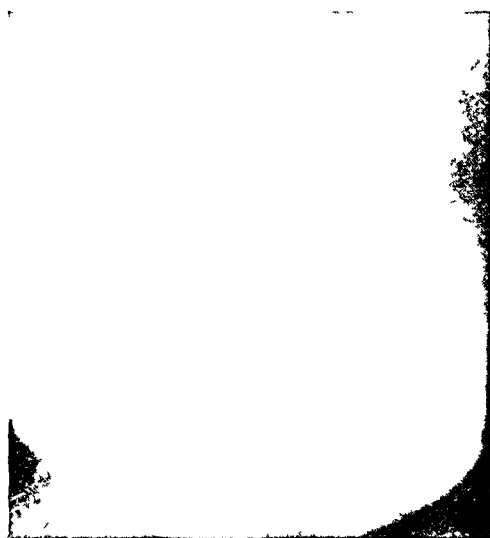


FIG 8—Coin placed over palpable mass (adrenal tumor). Renal pelvis low and distorted obviously the result of pressure and not destruction.

Regarding masses above the kidney A tumor arising from the adrenal shows several characteristic phenomena The renal pedicle is the kidney's chief point of fixation and forms the axis upon which the kidney moves

The renal axes are not parallel with the spine but oblique toward it at their upper poles at an angle of about 15° The adrenals lie upon and between the upper renal poles and the spine so that a tumor mass arising from one



FIG 9 —Pyelography displacement of kidney by tumor between its upper pole and the spine

of them pushes the upper pole away from the spine, thus straightening its axis parallel to that of the spine or divergent from it and also pushes the kidney down It has been our experience in palpating such tumor masses that, when sufficiently palpable, one can clearly distinguish this obliquity of the tumor toward the spine, forming, as it were, an arch consisting of kidney below and merging into the tumor above which approaches or even reaches the spine This we believe to be a characteristic physical sign of adrenal tumors In one instance of bilateral adrenal tumors the two formed a com-

plete arch Such must be distinguished from horseshoe kidney inverted from its usual form

The pyelographic evidence of such adrenal tumors follows this rationale

a The renal axis is parallel to or divergent from the spine

b The kidney is displaced down

c The upper renal calyces or pelvis are distorted or obliterated

It has been our experience that extra-renal tumor more likely distorts or elongates the calyces by pressure and distortion of the kidney while an intra-renal tumor more likely obliterates or fragments the calyces

CASE VII—*Adrenal Tumor vs Kidney*—(No 1751), Fig 8 Male, fifty-seven years old Complained of weakness with gastric distress and loss of appetite During the preceding six months he had lost thirty pounds in weight He complained of pain in the left flank extending down towards the groin, of a dull character

Examination—General nutrition poor, obviously anæmic and asthenic In the left flank there could be palpated a mass about the size of an orange which had been diagnosed as splenic enlargement It did not descend on inspiration was somewhat tender, firm, and extended nearly to the iliac crest

Blood count showed Red blood-cells, 2,800,000, white blood-cells, 8000, polymorphonuclears, 60 per cent, small mononuclears, 28 per cent, large mononuclears, 10 per cent, eosinophiles, 1 per cent, transitionals, 1 per cent, hæmoglobin, 85 per cent Blood-pressure, 100/60

In order to differentiate this mass from the kidney a cystoscopy and pyelography were done The pyelography showed a markedly distorted renal pelvis lying in the left iliac fossa and an opaque mass above it clearly differentiating the kidney from an adrenal tumor A clear space was apparent between the mass and the spleen An exploratory operation proved the diagnosis and the impossibility of removing the growth Death occurred some months later with autopsy

CASE VIII—*Hypernephroma vs Kidney*—(No 2024), Figs 9 and 10 Male, forty-nine years old Complaint gross hæmaturia for six weeks, periodic, no pain, slightly increased frequency of urination (Examined for Doctor Hamann)

Examination Very well nourished, large framed individual Palpation showed the right kidney descending low on inspiration, but did not seem enlarged The mass was very deep-seated and it was impossible to feel the upper renal pole since what seemed to be the kidney did not descend sufficiently

Cystoscopy—Showed a functional capacity greater on the right than on the left side Right hæmaturia A pyelography (Fig 9) showed the right kidney two spaces low, its



FIG 10—Specimen pyelographised after nephrectomy

axis divergent from the spine above, a pressure partial obliteration of the upper calyx and a marked ureteral kink due to forcing down of the kidneys (Fig 10) After nephrectomy and pyelography on the specimen the obliteration of the calyx is clear

Pyelectasis (Hydronephrosis)—Small dilations of the renal pelvis, unless associated with other disease, *e g*, acute pyelonephritis or perinephritis, are not liable to present a mass confusable with other conditions. However, the large dilations due to various etiological factors which we are not here discussing, occasionally furnish some problems of diagnosis. To inspection and palpation an indefinite tumor may be more or less obvious, the proof

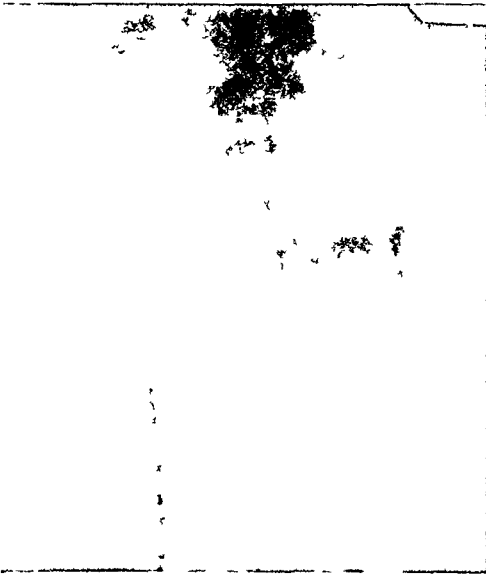


FIG 11 —Gross renal tumor destroying entire kidney

of which lies entirely with the passage of the ureteral catheter and the pyelography. A nervous hypersecretion may closely simulate an emptying of these cavities through a catheter. The old belief that they may empty rapidly through the ureter by straightening of a kink with renal colic is unfounded.

CASE IX—(No 2012) Female, fifty-eight years old. Three children living and well. This patient has been the rounds of specialists, has had various stages of neurasthenia, her tonsils removed, many teeth extracted, stomach lavaged, sanatoria, etc. She is an over-nourished, fleshy, inactive woman, has sour eructations, and tenderness and pain suggesting gall-bladder disease. She comes with the history of having recurrent tumor masses appearing in the right flank at

irregular intervals with attacks of pain, disappearance of the tumor and relief. This is obviously the ancient history of a large recurring hydronephrosis and has been so interpreted in her case.

It is strange how this poorly substantiated sequence has fixed itself upon the medical mind and literature resulting in false diagnosis. That it is impossible for a greatly dilated renal pelvis to empty itself so as to produce a large volume of urine in a short time is shown by the following facts. In such cases with a large catheter, *e g*, Nos 7 or 8 in the ureter, it requires two or three or more hours to empty the sac if left to itself. One can press upon the flank and produce a spurt or continuous flow but as soon as the tension is relieved resulting from a partial emptying of the sac, the flow reduces to a dribble increased more or less by respirations. Such a sac, holding 500 c c, which is unusual, without a catheter in place, probably never empties more than to relieve the tension, after which the sac remains with a large residual. The conception that a kink having been relieved, the urine gushes through the ureter to the bladder, resulting in the sudden passage of a large volume, is truly unreasonable.

Such patients after colic, it is true, may pass large volume of urine, but so

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do many others without such renal dilation, and the volume of urine capable of being secreted by nervous patients or those in pain has been shown to be enormous. The pyelography in this case showed a normal pelvis.

III

A tumor arising within the kidney may displace the kidney up or down, but it always destroys or fragments one or more of the calyces or obliterates

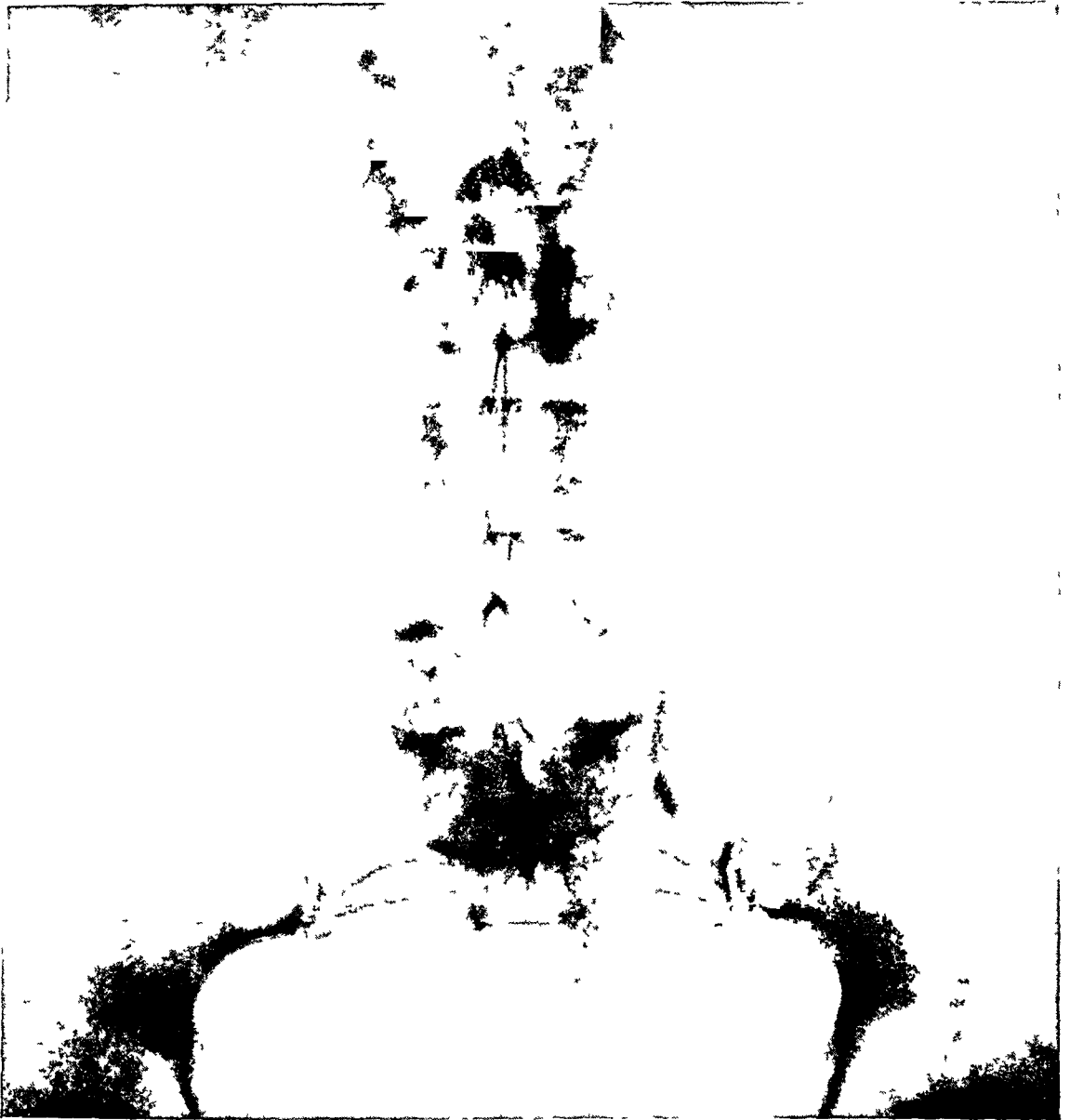


FIG. 12.—Left renal stones. Right ureteral stone (not clearly shown).

the entire pelvis. This is a well-known sign of renal tumor. The various conditions resulting in enlargement of the renal pelvis from obstructive pressure, *e g*, stone, stricture, kink of pressure from without, or ulceration, *e g*, tuberculosis, present then special characteristic features.

A tumor or abscess the size of a hazelnut in the parenchyma, not connecting with the pelvis, may result in a perfectly characteristic pyelography determining the presence of the mass but not necessarily its pathology. It is

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in such cases that a careful technic is especially necessary. A complete filling of the pelvis, or at least a complete lavaging of the entire pelvis in all its interstices with more solution than sufficient to fill the pelvis, is often essential. By so doing, a part of the solution runs down along the catheter to the bladder, as much as fifty c c being used in a pelvis with a capacity of perhaps twenty



FIG 13 —Right pyelography after removal of ureteral stone shows a dilated pelvis and calyces not typical of back pressure fragmentation of calyces, no pyonephrosis, tumor with the accompanying symptoms only possible evidence

c c In renal tumor, the coin placed on the surface over the palpated tumor coincides with the pyelography if properly taken

These cases of intra-renal tumor comprise the group of tumors most easily diagnosed by pyelography. Obliteration of the entire pelvis, or one or more calyces with hæmaturia, gives the diagnosis

CASE X—*Large Renal Tumor*—(No 2058), Fig 11 Male, fifty years old. Complaint gross hæmaturia. Cystoscopy showed hæmaturia to be from the left side

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Pyelography showed an obliteration of all of the calyces, with the injected fluid filling the pelvis only. This was a typical picture of gross renal tumor substantiated by operation.

The cases of tumor causing the greatest difficulty in diagnosis are those presenting two pathological lesions, *e g*, stone and tumor or pyelactasis and tumor.

CASE XI—*Stones and Tumor*—(No 2079), Figs 12 and 13. Male, sixty-eight years old. Complained of gross painless hæmaturia for the past six months which had reduced his hæmoglobin to 40 per cent. He had had no colics nor passed any calculi but he had slightly increased frequency of urination, getting up two or three times a night.

Examination showed a fairly nourished individual, although anæmic and suggesting cachexia. Both kidneys were palpable but not tender. The right was the larger and felt firm. X-ray showed a large calculus in the left kidney, and a small one apparently obstructing the upper end of the right ureter (Fig 12). The blood was considered as being caused by stone irritation and came from the right side as shown by cystoscopy instead of from the left side, which contained the larger stones.

The left urine as obtained through a Garceau catheter, contained but 15 per cent phthalein in fifteen minutes. This was con-

sidered the poorer kidney because of the low P S P output and the large stones. His blood chemistry showed forty-two milligrams of urea nitrogen, four and three-tenths uric acid and 1.13 creatinin per hundred c.c. Because of the persistence of hæmaturia, it was impossible to determine the gross P S P output and that of the right side.

It was determined that the blood was coming from the right side, that the right side was apparently the better kidney, and that there was a stone partially blocking this ureter. Anticipating a left nephrectomy, this stone was removed under local anæsthesia. The patient made a good recovery.

The hæmaturia, however, continued. His P S P output from the left side had increased to seven and one-half per cent in fifteen minutes. He was transfused. It was determined by pyelography (Fig 13) that there was a tumor of the right kidney. This tumor therefore was the real cause of the hemorrhage. The kidney was therefore removed under local anæsthesia, after transfusion. The patient did well and left the hospital.

Four months after first seen, in spite of the presence of the calculus in his remaining left kidney the P S P output in *three hours* was sixty-nine per cent. A local recurrence of his tumor occurred which proved to be a malignant papilloma, and the patient died some months later. In this case the diagnosis was confused by stones and impossible until the removal of one from the right ureter.

CASE XII—*Stones and Tumor*—(No 667), Fig 14. Male, fifty-five years old. He had suffered from pain in the upper left flank for about six years. Three years previously a surgeon had explored and concluded the tumor encountered as not removable.

Examination showed a poorly nourished man with a cocoanut-sized tumor in the left

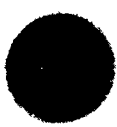


FIG 14.—Dilation of pelvis and calyces not typical of back pressure only, fragmentation of calyces. Tumor with stones.

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flank movable with respiration, firm, fluctuant, smooth and tender. The colon on inflation was in front of the mass, the stomach to its right. Urine contained albumin one plus, pus and a few casts. Red blood-cells, 4,700,000, white blood-cells, 7200. Gross P S P, 40 per cent in two hours. His prostate was large, firm, and he had 200 cc of residual urine.

The patient was transfused and the left kidney removed under gas anæsthesia through the abdominal route. He did well for two weeks, but as should have been expected his prostate was causing trouble, since he had some retention and the P S P output had fallen to sixteen per cent in two hours. A retention catheter resulted in improved excretion and another transfusion brought him to recovery.

SUMMARY

1. A coin placed over a palpated mass and a pyelography aids in the differentiation between intra- and extra-renal tumors.

2. Variation of the renal axes as shown by pyelography is often of great value in differentiating renal or extra-renal masses. The course of the ureter and its relation to the mass is suggestive.

3. Tumor without the kidney is more likely to change its axis and distort the pelvis or calyces.

4. Tumor within the kidney is more likely to obliterate or fragment the calyces.

ACUTE KNEE-JOINT INJURIES*

BY CONSTANTINE J. MACGUIRE, JR., M.D.

OF NEW YORK, N. Y.

IN A recent article on joint conditions Blake¹ called attention to the striking similarity in many of the factors involved in the surgery of the peritoneal, pleural and joint cavities.

In the development of abdominal surgery it was appreciation on the part of the surgeon that in the peritoneum he had an ally, rather than an enemy, that not only diminished fear of infection, but simplified its management when it had developed. The thoracic surgeon has developed a similar point of view toward the pleura. In the cavity of the knee-joint we have again a lining membrane which although different to some degree in histology and function, can nevertheless be regarded as also a strong barrier of defense against infection. Until the war, the opposite point of view was held, but since that time our increased confidence has brought more frequent surgical interference and different methods in dealing with suppuration and contamination.

The records of acute conditions in the knee-joint for the past five years on the First Surgical Division at Bellevue Hospital have been reviewed with the object of ascertaining to what extent this boldness has been justified.

The lesions have been divided into first, synovial membrane, second, ligaments, third, intra-articular fibro-cartilage, fourth, patella, fifth, intercondylar eminence.

I. *Synovial Membrane*—Acute synovitis is a condition that accompanies many other injuries to the joint, and it is rarely safe to regard it as a simple clinical entity. The associated lesion, however, is often so slight that its presence is not clinically manifested. Where there is enough fluid to cause pain, aspiration as strongly advised by McWilliams² is safe and definitely indicated, but where fluid is moderate in amount we have been in the habit of applying several layers of cotton over which uniform pressure is maintained by long narrow strips of basswood, firmly bandaged. Active motion is instituted early, but walking must be delayed or exudation will recur. Early aspiration is particularly useful in hæmarthrosis before much clotting has developed. Where a penetrating wound or laceration has extended into the joint cavity, immediate debridement with suture of the capsule without drainage was practiced in the only case that we had without bone involvement, and the joint remained free from infection. Another knee-joint which had been perforated by a bullet passing through the femur and lodging in the articular surface of the tibia resulted in perfect function in two weeks after débridement and primary suture, thus permitting early transfer to Sing Sing.

It is with the purulent exudates in the knee-joint that our methods of

* Read before the New York Surgical Society, January 27, 1926.

procedure have been most markedly altered. In civilian life, suppurative conditions of the knee-joint due to external trauma are very few as compared with the number seen during the war, and the Willems' method was published so late in the war that many of us have been left uncertain as to the result of its application in individual practice.

Our personal observations have been confined to ten cases exclusive of those which were late complications of extensive osteomyelitis. Of these ten, three were metastatic, four followed lacerations or penetrating wounds, one followed trauma without laceration, one resulted from the slipping into the joint of calipers applied for fractured femoral shaft, and one followed a post-operative infection of the curetted cavity of a giant-cell sarcoma in the head of the tibia. In six instances the organism was found to be staphylococcus aureus, in three streptococcus, and in one there was an anaerobic infection from the Welch bacillus which by the way made a complete recovery.

The treatment of these cases varied. One knee-joint which showed thick yellow staphylococcus pus, apparently metastatic in origin from infected tonsils, cleared up completely in about eight days after three aspirations without any open drainage, thus proving a striking demonstration of the natural resistance of the joint if not traumatized or surgically insulted.

In the other nine a strenuous effort was made to observe the principles of Willems' ³ treatment, namely, wide lateral incisions, avoidance of all drainage material, and active ambulatory motion. In most of the patients varying modifications were forced upon us. For instance, where the infection had been introduced through a compound fracture of the patella, active motion could only be obtained after wiring the patella. This was done and was followed by osteomyelitis, failure of drainage, and amputation performed barely in time to prevent death from sepsis.

There was another instance of complete failure of Willems' treatment and final urgent amputation in the case of suppurative knee-joint following curettage of a giant-cell sarcoma.

Of the remaining cases, five ultimately obtained full function, one has 15° of motion, and one has complete ankylosis but a useful limb.

One of the cured cases was that in which the calipers had invaded and infected the joint. Because of the fractured femur active motion was impossible, and yet the joint cleared up under lateral incisions and irrigations with Dakin solution. As a rule when a suppurative arthritis is being maintained by a communicating bone lesion, amputation had best not be too long delayed. Insufficient drainage from lack of active motion or other cause will result in faulty milking out of the posterior bursæ by the gastrocnemius and finally rupture and pocketing in the calf. This development is usually an indication of ultimate failure.

It is exceedingly difficult to obtain active cooperation from civilian patients, but when obtained early Willems' treatment gives results that form a dramatic contrast to the mournful progress offered by tube drainage, Mayo's operation or resection.

ACUTE KNEE-JOINT INJURIES

2 *Ligaments*—The usual text-book description of the mechanics of the knee-joint tend to give a false impression of the relative importance of the various ligaments. We hold this view as a result of several dissections made on fresh knee-joints subsequent to amputation. The anterior crucial ligament is quoted as being a great factor in preventing hyperextension. Independently of the anterior crucial ligament, hyperextension is definitely limited by the lateral and posterior ligaments. This could be demonstrated by cutting only the anterior crucial ligament. Another misconception is as to the size and mobility of the external semilunar cartilage. It is loosely attached to the capsule and very firmly attached anteriorly and posteriorly to the crucial ligaments. It is wider than the internal, and has a very extensive rotary motion during flexion. The internal meniscus is very firmly attached to the capsule and has rather weak anterior and posterior attachments. The anterior attachment divides in two, to attach in front to the transverse ligament and just behind this to the anterior crucial ligament, and this is the origin of longitudinal fractures, as pointed out by Osgood and Surles⁵. Also it was noted that these structures are attached in front and behind the spine and not to the spine itself, which therefore might be fractured without much involvement of the other structures. The capsule is particularly thin on the inner side of the patella, making this a favorable spot for aspiration.

With the knee in 30 degrees of flexion a sufficient period of immobilization instituted immediately should permit satisfactory healing of the crucial or lateral ligaments. (Henderson⁴). We have in three instances attempted repair by suture of tears in the internal lateral ligament. The repair is made difficult by the fact that the torn ligament is often shredded, rather than cleanly ruptured, and also that the attachment to the tibia or femur may be torn off the bone. There was one instance of outward dislocation of the leg with a complete tear of the internal lateral ligament and a clean transverse tear of the anterior crucial ligament, as seen at operation. Open reduction and suture of the lateral ligament brought a perfectly functioning knee in two weeks, although no attempt was made to repair the anterior crucial ligament. It does not seem reasonable that any operation such as the Héy-Groves which is dependent on the transplantation of a fascial strip in the site of one or the other crucial ligaments could give any benefit other than that derived from the period of immobilization following operation. These methods are often spoken of but rarely if ever practiced. A good repair of the internal lateral ligament is a better substitute for the anterior crucial. A reefing of the internal lateral ligament with fascial transplant, if necessary, is indicated where insufficiently early immobilization has resulted in an unstable knee. There was one rupture of the quadriceps tendon and another of the ligamentum patellæ. Immediate suture in both these cases was followed by a very good result.

3 *Intra-articular Fibro-cartilage*—In dislocation and fractures of the intra-articular fibro-cartilage, either internal or external, we have followed the usual practice of preliminary immobilization for six weeks or more in

TABLE I
Acute Suppurative Arthritis of Knee joint

Case	Etiology	Organism	Treatment	Results
G S, M, 43, No 2835	Laceration into knee-joint, Oct 7, 1922	B Aerogenes capsu- latus	Willems' treatment	Dec 16, 1922, crutches, March 20, 1923 function 80%, Sept 28, 1923, perfect function
P C, M, 28, No 4654	Traction calipers slipped in- to joint, Feb 4, 1925	Staphylococcus aureus	Lateral incisions and irrigation with Dakin No motion	Sept 14, 1925, walking without limp Ca- liper wounds discharging Oct 1, cured Dec 1, 1925 full function
J R, M, 32, No 5276	Metastatic, probably tonsils, Aug 24, 1925	Staphylococcus aureus	Attempted Willems' but pa- tient did not cooperate	Dec 15, 1925, only 15 degrees of motion Ankylosis probable
A S, M, 20, No 5067	Metastatic, March 26, 1925	Staphylococcus aureus	Willems' Poor cooperation	Long course with inability to cooperate on active motion Oct 6, 1925, com- plete ankylosis Useful limb
E K, M, 35, No 2641	Penetrating wound, June 9, 1922	Staphylococcus aureus	Attempted Willems' Poor co- operation	Wounds ultimately healed with 90 to 165 degrees of motion Developed 3 plus Wassermann and Charcot joint Wears brace
F B, M, 35, No 2791	Infected curettage giant- cell sarcoma, June 14, 1922	Streptococcus hæmo- lyticus	Willems' failed Amputation lower thigh	Amputation stump infected Reamputa- tion necessary Should have had pre- liminary disarticulation
B M, M, 15, No 4580	Metastatic, Dec 10, 1924	Staphylococcus aureus	Three aspirations No open drainage	Sepsis subsided in 4 days under aspiration Dec 23, 1924, full function
J A, M, 29, No 2372	Fell on knee, May 12, 1922 No laceration Admitted, May 19, 1922	Streptococcus hæmo- lyticus	Willems'	Dec 19, 1922, full function Moderate periarticular thickening
R B, M, 11, St V H	Laceration into knee, Nov 10, 1922	Staphylococcus aureus	Willems' Walking same day	Walking in 24 hours Squinting out pus Wounds closed Feb 1, 1923 Incomplete extension June 1, 1923, full function
W S, M, 34, No 3453	Compound fracture of pa- tella	Streptococcus hæmo- lyticus	Patella wired and Willems' at- tempted Failure Amputa- tion	Prolonged convalescence due to infected amputation stump Should have had preliminary disarticulation

the recent cases, in the hope that the lesion might heal. Most of our cases come to us, however, with a long history, many of them being city firemen. These lesions very rarely do heal without operation, and there would probably be a saving of time and less injury to the joint if the cartilage were excised on establishing the diagnosis. There is no question that recurrent locking and synovitis cause a permanent relaxation of joint structures. We have had fifteen operative cases, thirteen of the inner and two of the outer meniscus. There are three main types of trauma causing this injury, first, a fall on the foot with the knee in extension, second, a direct blow to the knee with the knee in flexion, third, twisting of the knee as in baseball or football, where there is a fall with the leg doubled under. One case gave no history of trauma at all. The pre-operative symptoms and operative findings are all indicated on the chart. Various means of approach were used, including split patella and dislocation of patella, but the simple lateral L-shaped incision always gave a satisfactory field. The external meniscus was in neither case detached anteriorly, although this was very common with the inner meniscus. There is no exposure that permits visualization of the posterior attachment. We had two cases of longitudinal fracture of the inner meniscus. In chronic cases a thickening and congestion of the ligamenta alaria and mucosa were frequently noted. In one case the suture of the loosened inner meniscus was followed by a satisfactory result as was also the removal of the deeper half of the longitudinally fractured inner meniscus in one of these instances. As a rule, however, the best results are those in which all of the accessible cartilage has been removed. If much of the posterior stump is left it will cause a distinct clicking sensation or bumping during convalescence.

Of the fifteen cases, eleven had normal function before discharge from the Follow-up Clinic. Of these eleven several went through a period of synovitis, instability and difficulty in going up and down stairs, but they were all free from symptoms for a considerable period before being closed. Of the remaining four, two were visited and were apparently without disability but did not report to clinic. Of the remaining two, one developed a post-operative phlebitis which delayed his recovery and subsequently developed a definite lateral mobility with instability of the knee. X-ray showed a calcareous deposit. The other was a bad result in which there was a persistent complaint of pain. The knee is free from fluid and shows no lateral mobility. Compensation in this case has never been settled. The most annoying post-operative complaint is the feeling of instability in the knee, but this ultimately disappears as the knee readjusts itself. The building up of the inner side of the shoe does not seem to be of any particular advantage. Our patients at Bellevue cannot afford to be laid up for a long period or with recurrent disability, and the immediate removal of all injured menisci would seem indicated. The X-ray gives very little, if any, diagnostic aid.

4 *Fracture of the Patella*—There were twenty-five fractured patellæ, twenty-four simple and one compound. The compound case has been discussed under suppurative arthritis. Of the twenty-four simple fractures,

TABLE II
Fractures and Dislocation of Intra-articular Fibro-cartilages

Case and date of admission	Date and type of trauma	Symptoms and signs	Operation	Results
W R, M, 45 Apr 13, 1920 No 422	4 months previous Fell on foot with knee in extension	Stiffness and swelling, no locking Tender over inner meniscus	April 17, 1920, inner meniscus loose Fracture of posterior 3rd Meniscus excised	Post-operative phlebitis, Nov, 1925, bad result Distinctly unstable knee Tends to walk with knee stiff X-ray shows calcareous deposit
H J, F, 40 Oct 27, 1920 No 844	May 6, 1918, fell on knee with knee in flexion	Recurrent synovitis in spite of long immobilization Knee gives way but never locked Flexion 45 degrees Inner meniscus tender	Nov 1, 1920, meniscus loose Not fractured Meniscus sutured to capsule	Jan 27, 1922, greatly relieved Still has pain on climbing stairs March 12, 1923, symptom free Perfect function Case closed
G T, M, 20 Mar 7, 1921 No 1139	Small piece of cartilage removed 3 yrs before following injury at basket ball	Cured until one month ago Repeated locking since Small hard movable nodule outer side of joint	Mar 12, 1921, fracture middle of ext meniscus Excision	July 5, 1921, perfect function Case closed
V J, M, 18 Apr 25, 1921 No 1275	2 years ago, fell on foot with knee extended	Locking once a month Slight external angulation External cartilage tender, lateral mobility	Apr 30, 1921, incomplete external meniscus, fracture, excision	June 21, 1921, slight lateral mobility Otherwise good function Did not report again
H L, F, 24 June 13, 1921 No 1418	15 months ago kicked in right knee	One month in plaster cast followed by repeated locking Extension 135 degrees Flexion, 90 Tender over inner cartilage	June 18, 1921, inner meniscus loose, not fractured Inner meniscus excised	June, 1922, perfect function Case closed
W S, M, 27 June 24 1921 No 1437	3 yrs ago twisted playing baseball	No locking Recurrent collapse of knee Limitation of extension and flexion Inner cartilage tender	July 3, 1921, split patella exposure Anterior 3rd of cartilage loose in joint Excision of inner meniscus	April 3, 1923, symptom free except for occasional click inflexion, probably due to post stump of meniscus
J N, M, 29 Nov 5, 1921 No 1852	4 yrs ago blown up by submarine Cured after immobilization until 3 months ago	Repeated locking Swelling Full motion Inner meniscus tender	Nov 29, 1921, longitudinal fracture, inner fragment loose Anterior two-thirds inner meniscus excised	Jan 17, 1922 No objective symptoms but marked subjective instability June, 1922 symptom free Function, 100%

ACUTE KNEE-JOINT INJURIES

J M, M, 43 Dec 8, 1921 No 1861	25 yrs ago kicked at football and missed it Dis-ability recurred 1 year ago	Swelling, pain lateral mobility Local tenderness and swelling over meniscus	Dec 19, 1921, transverse fracture inner meniscus Excision of inner meniscus	June 6, 1922, occasional pain in outer side of knee Jan 16, 1923, symptom free Function, 100%
H D, M, 35 Apr 12, 1922 No 2193	6 months ago Swelling and pain No trauma	Recurrent synovitis Pain and catching in semiflexion Limitation of motion Inner meniscus tender	Apr 15, 1922, inner meniscus loose anteriorly Excision	June 6, 1922, operated knee, 100% Pain complained of in non-operated knee, May 20, 1924, both knees, 100%
F F, M, 30 Jan 19, 1923 No 2924	2 yrs ago fell on knee in semiflexion	Swelling, pain, recurrent locking Tender over inner meniscus	Jan 22, 1923, meniscus mobile No fracture Synovial fringes thickened Excision of meniscus and fringes	May 19, 1925, has complained of pain since operation Examination negative Compensation complex
J G, M, 29 June 13, 1923 No 3160	6 months ago leg twisted between 2 autos 4 wks in plaster cast	Repeated locking In complete extension because of pain Inner meniscus tender	June 16, 1923, inner meniscus fractured Anterior half curled inside of joint Excision	Sept 18, 1923, pain and sense of instability Complete motion Lateral mobility, Oct, 1925, symptom free Full duty as patrolman
W L, M, 16 June 13, 1923 No 3385	4½ mos ago fell on knee	Swelling, pain, repeated locking Fixed at 135 degrees inner meniscus tender	Oct 1, 1923, inner meniscus attached at ends but free from capsule Excision	Aug 5, 1924, symptom free Complete function
I L, F, 23 Nov 26, 1923 No 3794	2 days ago fell with knee twisted under her	Pain, swelling, tenderness and lump over inner meniscus	Dec 1, 1923, anterior half of meniscus torn partially across and detached anteriorly Excision	May 22, 1924, failed to report in person but was seen working as waitress without apparent disability
E L, M, 37 Oct 16, 1923 No 3720	6 mos ago fell in a hole on foot with knee semi-flexed	Swelling, pain, recurrent locking Tenderness and crepitus over inner meniscus	Oct 27, 1923, inner meniscus detached anteriorly Excision	Feb 27, 1924, subjective instability Objectively neg March 17, 1925, symptom free Function, 100%
D K, M, 35 Jan 16, 1925 No 4675	2½ yrs ago, lifting barrel with knee flexed Plaster cast 3 months	Repeated locking Tender over inner meniscus No swelling	Jan 23, 1925, longitudinal fracture of inner meniscus Excision of loosened inner portion	April 7, 1925, symptom free Function 100%

TABLE III

Case	Date and type of injury	Date and type of operation	Date of discharge	Separation Ante-op	Separation Post-op	Union by X-ray	Follow-up
1278 F L, Male, Age 29	Apr 23, 1921 Direct	Apr 30, 1921 Suture of capsule	June 1, 1921	2.5 cm	O	Bony	Discharged from clinic Sept 1, 1921 Perfect
1417 L R, Fem, Age 30	May 24, 1921 Indirect	June 3, 1921 Suture capsule	July 8, 1921	5 cm	O	No X-ray	Nov 20, 1923 Flexion only 90°, otherwise good function
1892 L B, Male, Age 23	Dec 5, 1921 Indirect	Dec 9, 1921 Suture capsule	Jan 19, 1922	2.5 cm comminuted	1.5 cm	Fibrous	Apr 4, full function X-ray shows absorption lower fragment
2020 G M, Male, Age 51	Jan 22, 1922 Direct	Jan 31, 1922 Suture capsule	Mar 5, 1922	3 cm	O	Bony	June, 1922 Full function but effusion and crepitus present Dec 19, 1922, symptom free
2381 E P, Male, Age 35	June 4, 1922 Direct	June 5, 1922 Suture capsule	June 29, 1922	3 cm	O	No late X-ray	Dec 5, 1922 Function 100% but fluid present, June 5, 1923, symptom free
3384 J R, Male, Age 43	June 9, 1923 Direct	O	July 5, 1923	Barely any		No late X-ray	Aug 20, 1923, symptom free
3457 W S, Male, Age 34	Apr 23, 1923 Compound	Amputation for sepsis	Sept, 1923	Compound	Amputation		Artificial limb
3744 M O, Fem, Age 56	Oct 31, 1923 Direct	O	Nov 27, 1923	Comminuted		Fibrous	Mar 2, 1924 Only 30° of flexion Ext 170° weak

ACUTE KNEE-JOINT INJURIES

	May 3, 1924 Indirect	O	June 6, 1924	¼ cm Incom- plete			Sept 10, 1924
4168 A B, Male, Age 43							Full duty as fireman
1204 M R, Fem, Age 34	Mar 15, 1921 (Left side) Direct	Mar 22, 1921 Suture capsule	Apr 15, 1921	4 cm	1 cm	Fibrous	3 days after adm was delivered Op under local Follow-up May 17 Function 100%
Ditto Opposite patella	Jan 28, 1922 Right side Indirect	Feb 1, 1922 Suture capsule	Mar 1, 1922, 30° flexion	3 cm	O	Fibrous	Oct 3, 150% function Has "creak" Apr, 1923, symptom free
937 E H, Fem, Age 29	Nov 29, 1920 Direct	O Immed motion	Dec 10, 1920	Longitudinal fracture without sep	O	Bony	Apr, 1921 Perfect
888 N W, Fem, Age 52	Sept 5, 1920 Forcible flex- ion	Sept 30, 1920 Oct 30, 1920 Suture and resut- ure	Fell and re- fractured Oct 30, 1920	1st time 3 cm 2nd time 1 cm	1 cm	Fibrous	In spite of palpable separation ob- tained full function in 8 mos
790 J O'H, Male, Age 36	Sept 9, 1920 Direct	Sept 15, 1920 Fragment excised Suture capsule	Oct 10, 1920	4 5 cm com- minuted	O	Bony	Aug 1, 1921 Full duty as fire chief
4173 S M, Fem, Age 60	Sept 16, 1924 Direct	Sept 21, 1924 Suture capsule	Oct 20, 1924	2 5 cm	O	Bony	Dec 29, 1924 Flexion still limited to right angle, no further visit
2127 J M, Male, Age 35	Mar 19, 1922 Direct	O Immediate motion	Apr 12, 1922	O	O	?	July, 1922 Perfect
C H, Male, Age 29	Aug 20, 1922 Direct	Aug 24, 1922 Suture capsule	Sept 24, 1922	5 cm com- minuted	2 cm	Fibrous	Immediate result good but failed to return

TABLE III —(Continued)

Case	Date and type of injury	Date and type of operation	Date of discharge	Separation Ante-op	Separation Post-op	Union by X-ray	Follow-up
1299 E W, Fem, Age 32	July 7, 1924 Direct	July 10, 1924 Suture capsule	Aug 10, 1924 Flexion 90°	5 cm	2 cm	Fibrous	Oct 21 Lacks 10° of full ext Failed to return again
5174 G Q, Male, Age 36	June 20, 1925 Direct	June 22, 1925 Suture capsule	July 20, 1925	4 5 cm	5 cm	Fibrous	Oct 21, 1925 Palpable gap but perfect function
663 E C, Male, Age 54	Jan 1, 1925 Direct	Jan 18, 1925 Suture capsule	Jan 31, 1925	3 5 cm	1 cm		Lost This patient had had an old fracture of opposite patella
65 R D, Male, Age 47	Oct 4, 1919 Direct	O	Oct 29, 1919	1 cm		Bony ?	Firm union but on Sept 3, 1920 was still limping
453 A B, Male, Age 44	Apr 1, 1920 Direct	Apr 5, 1920 Suture	Apr 25, 1920	2 5 cm	1 cm	Fibrous	Full flexion and extension on May, 1, but persistent "cracking" Sept, 1921, perfect
415 T M, Male, Age 48	Sept, 1919 Direct	Mar 26, 1920 Excision of old scar and suture	Apr 30	2 5 cm	1 cm	Fibrous	Had disability and fluid before operation Mar 22, 1921 No fluid 90° of function
J M, Male, Age 21	Aug 29, 1925 Direct	Sept 1, 1925 Suture capsule	Sept 21, 1925	2 5 cm	1 cm	?	Nov 17, 1925 Moderate effusion X-ray shows tilting Flexion 90° Not readjusted yet

ACUTE KNEE-JOINT INJURIES

seventeen were operated upon. Of the seven not operated upon, six had hardly any separation, and one refused operation. Sixteen sustained their fracture from direct violence, falling with knee in flexion. Only two gave a clean cut history of indirect violence. The others were contradictory. The procedure in all was about the same. The time of operation after injury varied, there usually being about a five-day interval. The exposure was made with a curved transverse incision with convexity upward. The lesion was repaired by chromic sutures for the lateral tears in the capsule thus approximating the fragments. Local anæsthesia was used in four cases and was very satisfactory. Lane technic was used as long as the patience of the individual operator permitted. As usually practiced on a general service, it is imperfect and a distinct handicap to the secure tying of sutures. All these cases were followed until complete function had been restored, with the exception of two cases which failed to report and one which reported only once, the immediate result being good. One of the cases that failed to report was a non-operative case.

Following operation immediate massage and active shuffling of the quadriceps was practiced. Passive and active motion of the joint were instituted in ten days. Patients were allowed on crutches in three weeks and were walking without support in one month. Active extension to 180° is almost always present at the end of two weeks, but flexion is markedly limited and should not be forced. In one case where passive motion was started on the fourth day the suture line opened up. Active motion is much safer than passive. At the time of operation the lower fragment is invariably found turned forward. When the two fragments are held together and sutures placed in the lateral tears, the posterior borders will very often stay approximated while a gap appears in the anterior borders. Subsequently there is slipping of the approximated posterior borders, and one or the other will form a sharp ridge projecting into the joint, thus interfering with the action of the three articular facets as they glide on the articular surface of the femur and this may be a cause of subsequent synovitis and irritation. It was present in several cases but always ultimately disappeared. In about half our cases we felt certain that only fibrous union took place, but this was associated with no interference of function, although it may subsequently increase the possibility of refracture. A firm suture of the lateral tears gives splendid results, but to increase the chance of bony union and to prevent inequality of approximation on the posterior surface a finer suture of the bony fragments themselves could be easily accomplished by kangaroo tendon passed through holes that did not enter the joint surface.

Incision with convexity upward gave a satisfactory scar quite removed from the opening in the capsule and with less post-operative œdema.

The results are so strikingly satisfactory that there should be no question of the wisdom of operation in all fractures with separation. Several of our cases showed superficial infection, and post-operative œdema or temperature was the rule, indicating a possible reaction in the joint but no infection of the

joint itself has taken place as a result of operation in the series of thirty-seven operations on the knee-joint, fifteen for cartilage, seventeen for fracture of patella, and five for torn ligaments. In view of the fact that asepsis was not always maintained, this would indicate a rather strong defensive power in the joint itself.

5 *Intercondylar Eminence*—During this period there were treated four cases of simple fracture of the tibial spine. One at the end of nine months showed a perfect result. The other three after prolonged periods complain of recurrent synovitis and pain on standing, but none show abnormal mobility. The period of immobilization in thirty degrees of flexion averaged about six weeks and was associated with periodic active and passive motion.

Other fractures involving the articular end of the tibia were too numerous to present here, but apparently healing is as rapid and ultimate function as good as in non-articular fractures if the proper anatomical relations are restored. It is essential that avulsion or mushroom fractures be completely reduced and reduction maintained if necessary by nailing. We have one instance where perfect reduction was followed by recurrence due to failure to nail the fragments together.

Fixation of a comminuted intra-articular fracture with an ordinary nail was followed by early and complete restoration of function. The nail was removed without difficulty about a year later.

The broad title under which these rather loosely linked clinical findings have been presented would permit the inclusion for discussion of many other features. We have attempted, however, to cover only those problems for which our surgical service gave us clinical material.

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CUTANEOUS CARCINOMA OF THE LOWER EXTREMITIES*

A STUDY OF CASES AT THE BARNES AND THE BARNARD FREE SKIN
AND CANCER HOSPITALS OF ST LOUIS, MO

BY CESAREO DE ASIS, M D

OF ST LOUIS, MO

THE aim of this paper is not to present any solution to any of the various aspects of the cancer problem, but to discuss the variety of carcinomata of the lower extremities and the course taken by this disease arising in this region of the body. The material was obtained at the Barnes and the Barnard Free Skin and Cancer Hospitals.

Frequency—Of all the carcinomata found in the different regions of the body, those of the lower extremities are the most rare. Biodeis reports 12 cases of carcinoma of the lower extremities out of 2000 admitted to the Mayo Clinic between November 1, 1904, and July 22, 1915. The writer has obtained 7 cases out of 723 cases of carcinoma now (December 1, 1923) recorded in the Barnes Hospital, and 10 cases out of 6043 cases of carcinoma recorded at the Barnard Free Skin and Cancer Hospital. (See Table I.)

TABLE I

Frequency of Cutaneous Carcinoma of the Lower Extremities

	Period (yrs.)	Total no ca. cases	Ca. of lower extremities	Percentage
Mayo Clinic	10.5	2000	12	6
Barnes Hospital	11.0	723	7	1.0
B. F. S. and C. Hospital	18.0	6043	10	.2

Pathology—It is claimed by Bloodgood that there are only two important types of cutaneous carcinoma, namely, the squamous-cell carcinoma and the basal-cell carcinoma of rodent ulcer. The mode of development, as well as the gross and microscopic findings in each variety, will now be dealt with.

The squamous-cell carcinoma is a growth of squamous epithelium of the skin. This growth leads to a thickening of the epidermis and an invasion of the underlying structures. This tumor growth has its origin in the Malpighian layer. On account of the intercellular spines or prickles which the cells of this tumor show, it is called a prickle-cell carcinoma. The primary growth leads to masses of cells. Growth continues at the edge of these masses, the central cells undergo cornification or pearl formation.

Many of these neoplasms develop in old or long-standing ulcer or in scars of old burns. Those occurring on scars of burns are called Marjolin's ulcers. When a chronic ulcer undergoes malignancy, the malignant change starts at

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any point at the edge of the ulcer and is first manifested by the induration and thickening of the edges. This thickening is due to the overgrowth of the epithelial cells and to an increase of the connective-tissue cells. The growing epithelium spreads in all directions to involve also the cutaneous tissue outside the ulcer. The edges and bases of these ulcers become nodular and irregular in outline. The floor is irregular and is covered by necrotic cancerous tissue. This necrotic tissue is gray and opaque. The ulcer is hard and bleeds readily. The ulcer generally has a foul odor and may be very painful.



FIG. 1—Case III. Squamous cell carcinoma of the foot.

After the diagnosis of carcinoma has been made on an ulcer of the lower extremities by the history and gross appearance of the lesion, it is almost impossible to ascertain in all the cases without the aid of the microscope whether the case is one of squamous-cell carcinoma or basal-cell carcinoma. However, many of the rodent ulcers have a few things in common, namely, (a) the margin is raised, firm, rolled, and has a glossy or mother-of-pearl appearance, (b) the progress is slow (five to ten years is a common duration), (c) the lymphatic glands are, as a rule, not involved, (d) the ulcer is shallow and dry, sometimes covered by a crust and bleeds readily when rubbed, (e) pain is absent except in the later stages. Of these, the slow progress, the translucency of the border, and the non-involvement of the lymphatic glands differentiate rodent ulcer from squamous-cell carcinoma of the prickle-cell type.

Microscopically, rodent ulcers have no epithelial pearls. The cells are round (Fig. 2b), polygonal, or even spindle in shape (Fig. 3). The cell columns are not always sharply defined from the surrounding stroma.

Distribution—Either of these two types of cutaneous carcinoma can occur

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on cutaneous or muco-cutaneous surfaces, but collected data reveal the fact that they are most common in the region from the neck up and rare on the trunk and extremities (See Table II)

TABLE II

Distribution of Squamous- and Basal-cell Carcinoma

Barnes Hospital (squamous- and basal-cell carcinoma)				Percentage
Total number of cases		361		
Neck and up		280		78
Trunk		56		15
Upper extremities		18		5
Lower extremities		7		2
Barnard Free Skin and Cancer Hospital (squamous- and basal-cell carcinoma)				
Total number of cases		1105		
Neck and up		959		86
Trunk		39		4
Upper extremities		97		9
Lower extremities		10		1
Mayo Clinic and Johns Hopkins Hospital				
	(Mayo Clinic) (Squam cell)	(J H H) (Basal cell)	Total	
Total number of cases	256	178	434	
Neck and up	200	162	362	83
Trunk	12	6	18	4
Upper extremities	32	4	36	8
Lower extremities	12	6	18	4

Etiology—(a) Sex Cutaneous carcinomata in general are more common in males than in females. Biondini states that his 256 cases show a ratio of 4:1. The writer in his series has 12 males and 5 females. If injury, which is to be discussed later on, is an important factor in the etiology of carcinoma as is universally believed, then it is perfectly natural to expect that this malady would be more common in men, whose legs are more subject to injury than in women.

(b) Age—Almost every writer says that cancer is rare or seldom seen before forty, or that cancer is a disease of advanced years. The writer does not wish to contradict these statements, but wants to draw the attention of the readers to the fact that his series includes four cases aged twenty, thirty, thirty-one, and thirty-two, respectively, thus 4 out of 17 are below the cancer age as it is given in text-books. Is it not safe to say that these four cases are too many to be branded "atypical"? With these cases in mind one is tempted to assume that carcinoma arising from injuries, especially those on the legs—and injuries are very common on the legs—are not very rare in persons under forty as they are commonly supposed. It seems as though malignancy arising from injuries does not show much respect for youth. It is always a good thing to suspect cancer, even if the patient is still around thirty.

(c) Trauma—In glancing at Table III, it will be noticed that trauma

TABLE III
Synopsis of Cases

Case	Path No	Age—Sex	Location of lesion	Size of lesion	Duration of ulceration	Interval between primary lesion and appearance of malignancy	Probable cause	Wassermann	Glandular involvement (inginal)	Coexisting condition	Clinic diag	Micros diag	Treatment	Result when discharged	Present status
1	1935	32-M	Lt leg	6 x 4 cm	1 yr	22 yr	Trauma	Neg	Enlarged	Osteomyelitis of tibia	Ca	Squamous cell ca (prickle cell type)	Amputation	Improved	Uncertain
2	2471	58-M	Rt leg and post and lat surface of thigh knee and calf	36 x 10 cm	56 yr	54 yr	Burn	Neg	None		Ca (Rodent ulcer)	Squamous cell ca (prickle cell type)	Amputation	Improved	Uncertain
3	4568	31-M	Rt foot	Entire foot	11 yr	10 yr	Trauma	None			Ca	Squamous cell ca (prickle cell type)	Amputation	Improved	Living and well
4	4896	56-M	Lt leg below knee	5 x 8 cm	3 mo	3 mo	Trauma	+++	Enlarged		Ca	Basal cell ca	Excision in toto Salvarsan	Improved	Uncertain
5	6310	60-M	Lt popliteal space	3 x 3 cm		30 yr	Burn	Neg	None	Contracture popliteal space	Ca	Squamous cell ca (prickle cell type)	Excision of cicatrix	Improved	Uncertain
6	6856	59-M	Lt leg	3 x 5 cm	1 yr			Neg			Ca	Basal cell ca	X-ray	Ulcer healed	Uncertain
7	6885	30-M	Lt tibia	6 x 8 cm	25 yr		Fracture of femur osteomyelitis	Neg	Enlarged	Osteomyelitis	Ca	Squamous cell ca (prickle cell type)	X-ray later amputation	Improved	Still under treatment

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	8	P-55	20-F	Lt thigh	Multiple	1 yr	9 yr	Burn	None			Ca	Squamous cell ca (prickle cell type)	Curret Skin graft	Ulcers healed	Uncertain
9	None	75-F		Rt thigh	10 x 10 cm	3 yr			None			Ca	None	None	Died 4½ yrs later	
10	P-721	62-M		Lt inguinal flexure	7 x 7 cm	1 yr			None			Ca	Squamous cell ca (prickle cell type)	Excision and fulguration	Not improved	Uncertain
11	None	53-M		Lt foot	Entire foot	30 yr		Trauma on old ulcer	None	Enlarged and suppurating		Ca	None	Amputation Glands excised	Left hosp 30 da after operation against advice	Dead (Cause not known)
12	14-114	63-M		Rt foot	Multiple ulcers and nodules	1 yr	20 yr	Burn (hot grease)	None	Enlarged but not metastatic		Ca	None	Amputation Glands excised	Improved	Uncertain
13	20-47	54-M		Rt leg and thigh	35 x 6 cm	5 yr	47 yr	Burn	None	Enlarged on rt		Ca	Squamous cell ca (prickle cell type)	Excision Skin graft later	Improved	Living and well
14	21-353	87-F		Rt heel	4 x 3 cm				None	Enlarged on rt		Ca	Basal cell ca (?)	Excision	Improved	Died 2 yrs later but not of ca
15	22-180	51-M		Lt leg and thigh	2 x 2 cm	4 yr	16 yr	Psoriasis	None		Psoriasis	Psoriasis and secondary ca	Squamous cell ca (prickle cell type)	Cautery and radium Skin graft	Improved	Uncertain
16	22-213	77-F		Ball of big toe on rt	1.5 x 2.5 cm	8 mo	6 yr	Trauma	None			Ca	Squamous cell ca (prickle cell type)	Excision and radium	Improved Recurred 1 yr later	Uncertain
17	23-49	67-F		Lt leg	30 x 15 cm	1 yr	51 yr	Chronic ulceration	Neg	Enlarged both sides	Varicose ulcers rt leg	Syphilis ca	Squamous cell ca (prickle cell type)	Amputation	Improved	Uncertain
18*	7575	52-M		Rt leg	8 x 10 cm	1 yr	14 yr	Trauma	None	Enlarged both sides	Varicose veins on both legs metastatic nodules in liver	Ca	Squamous cell ca (prickle cell type)	X-ray		Still under treat Shows some improve

* See supplement

plays a leading role in the etiology of these carcinomata. In some of these cases malignant growth started not very long after the injury, and in others years have elapsed before any manifestation of malignancy made its first appearance. In other words, the period of time elapsing between the infliction of the injury and the first appearance of the malignancy varies from a few months to years.

(d) Scars—Another predisposing factor which plays an important role in the etiology of cancer is the scar in the site of old trauma brought about



FIG. 2a—Case IV. Basal cell carcinoma (rodent ulcer) of the leg.

by burns. It is a common observation among surgeons that scars left by burns are very liable to become the seat of squamous-cell carcinoma, especially those situated on the lower extremities where they are more common than on the upper extremities or trunk. The malignant growth starts at the junction of the cutaneous tissue and the scar tissue. The other peculiar thing about burns on the lower extremities is that after

the amputation of the limb for carcinoma, there is a tendency for the disease to recur at the stump. The five cases in the series give a history of burns of many years ago. In one of these a simple ulcer had persisted for fifty-six years. He has no history of syphilis and gives a negative Wassermann. The four others give a history of primary healing of the burned area. Later, after several years, this area broke down. The second lesions failed to heal. Broders has shown that one-fifth of his cases had arisen from scars of burns, and he, therefore, suggests that scars should be watched for a possibility of malignancy. These cases, together with those reported by others, are enough to convince one that old scars have a decided tendency to ulcerate, that the ulceration refuses to heal, and finally leads to carcinomatous growth.

(e) Syphilis—As far back as 1843, it was argued by many observers—and with convincing evidence—that syphilis is a strong predisposing factor for carcinoma. Unfortunately not all the cases in the writer's series have had Wassermann tests, several of these were treated before the Wassermann test was in general use. Of the seven that had a Wassermann test only one gave a positive reaction. This particular case gave a history of trauma at the site of the cancerous growth. Either the trauma or the syphilis might have brought about the malignancy. However, it is of interest to note here in passing that a number of observers, among whom are Fournier and

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Poirier, believe that from 85 to 95 per cent of the cases with syphilitic lesions in different parts of the body develop carcinoma

(f) Varicose Veins and Varicose Ulcers—It is a question what part varicose veins and varicose ulcers play in the etiology of carcinoma. It is, however, generally accepted that chronic ulceration is an important factor in the causation of carcinoma. In the lower extremities, the most common cause of ulceration is varicose veins. In going over the histories of cases of varicose ulcer at the Barnes and the Barnard Free Skin and Cancer Hospitals, the writer has found 310 cases, all of which were practically within the cancer age and with a chronicity of from six months to thirty-five years. He found that only one had become malignant. These figures, together with the greater predominance of cutaneous carcinoma in men than in women (about 4:1) and the greater predominance of varicose veins and varicose ulcers in women than in men (4:1 according to White, and 3:2 in the writer's 310 cases of varicose veins and varicose ulcers), seem to show that vari-

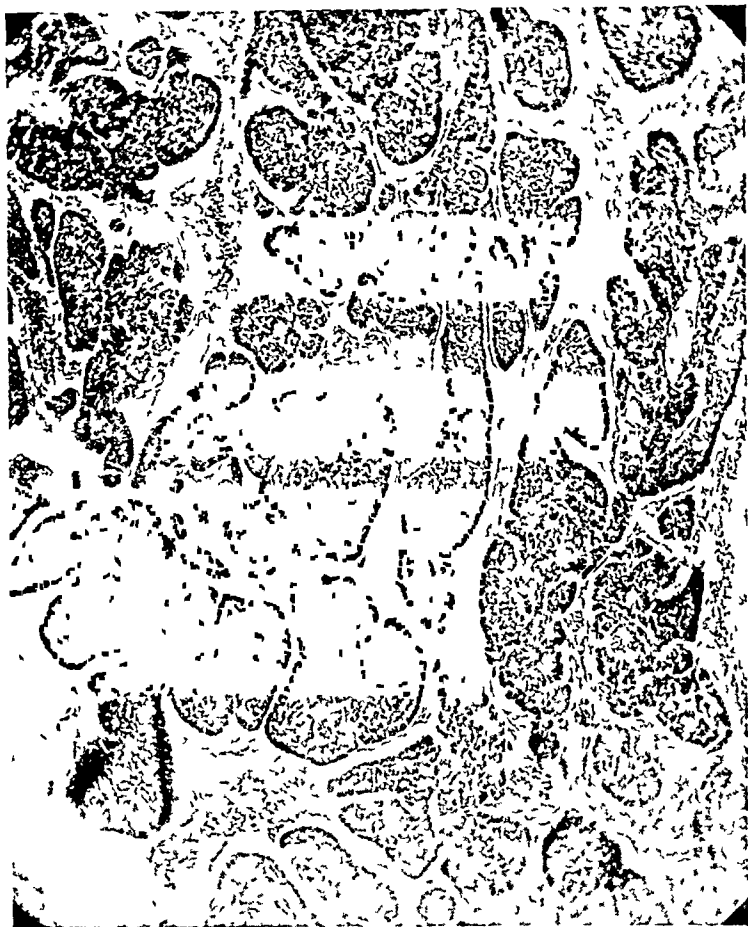


FIG 2b—Case IV Basal-cell carcinoma (rodent ulcer) Microscopic section of specimen shown in Fig 2a. The cells are mostly spherical in shape.

cos veins and varicose ulcers do not play a very important part in the causation of carcinoma of the lower extremities.

Metastasis—Cutaneous carcinoma of the lower extremities in particular, and cutaneous carcinoma of other regions in general, metastasize rather late. Many of them do not show any sign of metastasis at all in the inguinal glands at the time the patient applies for treatment. This slow or late metastasis is explained by the fact that the edges of the ulcer undergo thickening and induration which are believed to squeeze the lumen of the lymphatic vessels. This prevents the flow of lymph which ordinarily carries the cancer cells. In the cases here presented only two had the inguinal glands excised for some reason or other. Our only reason for suspecting metastasis in some of them is the presence of the enlarged inguinal glands. The enlargements of the glands may have been due to other causes. As to how long these inguinal

glands have become enlarged is a difficult matter to decide, for the clinical clerk seldom, if ever, asks the patient that question. Answers given by patients are also of doubtful importance. The fact remains, however, that some of these cutaneous carcinomata metastasize rather late for the inguinal glands in some of them are not even palpable even after the disease had grown so extensively as to justify the amputation of the limb. This fact of late metastasis, therefore, suggests that early excision might be quite sufficient to effect a cure, or at least, to avoid metastasis.



FIG 3 —Case VI. Basal cell carcinoma (rodent ulcer). Microscopic section of basal-cell carcinoma of the leg. Many of the epithelial cells are spindle in shape (compare with Fig 2b). Note the palisade like arrangement of the border cells.

time the patient applies for relief, the nature of the growth (whether basal cells or squamous cells), and also by one's personal choice based on his experience with his favorite method or methods. In a short paper like this there is no place for the discussion of all the different methods of treatment, together with their merits and demerits, though each may have its place under varying conditions. It might be of interest, however, to mention a few of these methods that have the most advocates and whose advantages are least questioned.

Amputation is the first choice under a number of existing conditions. If the malignant area is large, amputation is preferred and the results are satisfactory. This method of treatment is always called for in those cases which are associated with gangrene, with elephantiasis, and in large and incurable ulcerations that extend around the limb. These conditions usually mean that

Some observers have proved experimentally that metastasis in distant organs has occurred in animals simply by employing unnecessary handling or massage, during the operation. That unnecessary manipulation during the operation has caused metastasis is a well-known fact. Therefore, it behooves the surgeon to be as gentle as possible with the affected organ.

Treatment — The choice of treatment of carcinoma of the lower extremities like that of the other regions, is chiefly determined by the extent of the malignancy at the

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the limb is of no use to the patient. It, however, the growth is of the basal-cell type and is relatively small, less radical measures are often successful because of the more benign character of the lesion.

Excision with the cold knife or the electric cautery are, I believe, the most commonly employed. But the electric cautery is the more preferred of the two. It destroys avenues of escape for tumor cells to distant regions.

The Rontgen-ray, because of its success where other modes of treatment have failed, has rallied many supporters to its standards, most of whom are X-ray experts. But in the hands of a novice the danger of X-ray therapy lies in the resulting burn which almost never heals. The burn is exquisitely painful, and has a special predisposition to carcinoma. Radium also has been often used successfully, especially in those cases which are of the basal-cell type. But, similarly, caution must be exercised with regard to the production of a burn.

Electrocoagulation Method—This method of treatment is advocated on the ground that it prevents re inoculation or extension of the disease. It

is employed as an adjuvant to the other aforesaid modes of treatment.

The Combined Methods—It is fully recognized that none of the above-mentioned methods may be applicable to all cases of carcinoma. On this ground, Bryant and others advocate that radium and surgery will accomplish the best results. In this case radium is to be applied before and after the operation. The idea with the former is to render the cancerous cells temporarily inert during the operation, and the latter, to destroy or encapsulate the cancerous cells left behind. The advocates of X-ray, on the other hand, also claim that the greatest good is accomplished by the combined use of surgery and the X-ray. The arguments offered in support of either of these combined methods are plausible enough, but Pfahler was not satisfied with the results obtained by either of these combined methods. His idea was to "finish" those malignant cells which for unknown reasons were recrudescant



FIG. 4—Case VII. Microscopic section of a typical squamous-cell carcinoma with epithelial pearls.

after either of the above methods. He, therefore, suggested that perhaps the best results could be obtained by the combination of the electric cautery, radium, X-ray, and electrocoagulation methods. He, with many others, claims that these combined methods accomplish the greatest good and the lowest mortality.

REPORT OF CASES (BARNES HOSPITAL)†

CASE I—No 3791, E. T., male, thirty-two years old, well developed, muscular, and weighed 151 pounds. He entered the hospital on February 5, 1917, for an ulcer on the left leg below the knee. When nine years old he was hit on the hip with a clod of frozen dirt. A lump appeared which later was followed by other lumps on the leg below the knee. A physician opened the lumps on the hip and leg and bone fragments were removed. They healed. In 1911, he fell off a wagon and bruised his hip and leg again and soon after an abscess developed at the hip. Bone fragments were again removed from the hip and leg. Healing followed and the wound remained healed until 1916, when he had another injury on the shin. The wound never healed since. Three months previous to admission he suffered another injury. On examination the inguinal glands were found enlarged and firm. The ulcer was 6×4 cm. The edges were hard and tender but were not irregular. The base had a cauliflower appearance, and had a deep green foul discharge. X-ray examination showed osteomyelitis of the tibia. He had a negative Wassermann reaction. The left leg was amputated at the junction of the upper and middle thirds. He had improved when discharged, March 13, 1917. Efforts to locate him in order to ascertain subsequent results failed.

Pathology—The section of the ulcer shows isolated masses of different sizes and shapes made up of squamous epithelium surrounded by scanty amount of connective tissue and cellular infiltration mostly round cells and a few polymorphonuclear leucocytes. The epithelial cells at the border of these masses have a narrower protoplasm than those at or near the centre, and the nuclei stain more deeply with hæmatoxylin. The nuclei assume a variety of shapes. Some are round, others are oval, and a very few approach a spindle shape. The cells are uniform in size and regular in shape. The border cells make up from two to six layers but mostly from two to four. The oval-shaped nuclei have a transverse diameter much less than the diameter of the round ones. The intercellular spaces are more distinct near the border than at the centre. Epithelial pearls are present in the centre of the masses. The nuclei are fewer per unit area and do not stain so sharply. *Diagnosis*, squamous-cell carcinoma (prickle-cell type).

CASE II—No 5321, J. C. J., male, fifty-eight years old, entered the hospital, March 3, 1918, for a sore on the right leg. He received a burn when two years old. Since then it never healed in spite of the efforts of two doctors. At times the sore was small, but at other times it was extensive. The ulcer had a very large area covering the posterior and lateral surfaces of the right thigh, knee, and calf. The edges were indurated, raised, and irregular. The base was red and filled with unhealthy granulation tissue which gave it a nodular appearance. A slight amount of foul discharge was present. The left leg showed a slight degree of muscular atrophy. The right leg was flexed to the knee and this was the most comfortable position for the patient. In 1916-1918, the sore had spread so rapidly that it had grown from about one-half the length of his palm (9-10 cm) to about 36 cm in length. At the time he applied for treatment the ulcer extended from the junction of the middle and upper thirds of the thigh to the middle of the calf. He had been treated with salves. He had a negative Wassermann

† It is unfortunate that so few of the patients could be traced later in order to get information about their condition at the time of the preparation of this paper. It would seem as if there must be a particular tendency for patients with these lesions to belong to the "floating" class of the population.

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reaction The inguinal glands were palpable but not much enlarged An amputation was performed through the middle third of the thigh He was much improved when discharged, May 30, 1918 It has not been possible to locate him or to hear of his condition since his discharge

Pathology—The microscopic section shows invasive growths of epithelial cells arranged in masses which vary in size and shape These are surrounded by connective tissue and leucocytes The nuclei of the border cells stain deeply with hematoxylin They are round, oval, or spindle in shape In the centre of these masses the cells are less crowded, and the nuclei exhibit no uniformity of staining quality Some stain deeply while others stain faintly Characteristic pearl formations are present Many of the cells are undergoing mitotic changes Diagnosis, squamous-cell carcinoma (prickle-cell type)

CASE III—No 10,991, C M A, male, thirty-one years old, a mechanic by trade, entered the hospital, July 23, 1921, for a sore on the right foot On August 26, 1900, he was run over by a truck and his big toe of the right foot was cut off and the rest of the foot was skinned The toe was amputated at the City Hospital but the wound did not heal completely before he left the hospital This wound was later treated by a physician Partial healing followed but the remaining toes were in an abnormal position (Fig 1) He was unable to walk for four years The skin did not completely heal

In 1910, he was injured again on the right foot Ulceration began and did not heal since The duration of the ulcer was eleven years The base of the ulcer was about 15 cm thick on section and cut with difficulty The history does not state the presence of enlarged glands No Wassermann test was made on this patient An amputation was performed through the middle third of the right leg on July 29, 1921 He was discharged on August 12, 1921 He is now (December, 1923) living and well

Pathology—The microscopic section shows invasive growth of the squamous epithelial cells forming columns chiefly characterized by numerous epithelial pearls Many of these epithelial columns show signs of activity Mitoses are seen in their border cells Most of the epithelial pearls have undergone partial or complete necrosis The active cells stain blue with hematoxylin and the necrotic areas stain pink Diagnosis squamous-cell carcinoma (prickle-cell type)

CASE IV—No 11,658, J S, male, fifty-six years old, a miner by occupation, entered the hospital on November 6, 1921, for an ulcer on the left leg just below the knee-joint



FIG 5—Case X Microscopic section of squamous cell carcinoma showing the large typical epithelial cells and the absence of epithelial pearls (Compare with Fig 4)

and situated latero-posteriorly Six months before coming to the hospital he was struck on the site of the present ulcer with a piece of coal The skin was bruised There was no immediate swelling but the area was slightly tender He applied salves Two months later he noticed a slight swelling of the size of a peanut at the site of the old trauma The tumor grew and three months later it reached the size of a walnut (Fig 2a) Ulceration began to take place then There was a moderate amount of 'dirty, greenish-yellowish



FIG 6 —Case XIII Squamous cell carcinoma of the posterior aspect of the thigh knee and calf

discharge and slight bleeding at times The centre showed necrosis He suffered no pain The tumor (5 x 8 cm) was excised, November 29, 1921 He refused excision of the enlarged inguinal glands He had a four plus Wassermann and was given salvarsan treatment He was much improved when discharged, December 8, 1921 He did not report for further treatment He has not been heard of since

Pathology—The mass had the shape of a hemisphere measuring 7 x 6 x 4 cm It contained two ulcers on its outer surface Microscopically, the section (Fig 2b) shows irregular epithelial-cell masses surrounded by dense connective tissue The cells in these masses stain uniformly blue with hematoxylin There is no central pearl formation The masses are composed entirely of basal cells This is a picture of a typical basal-cell carcinoma All the larger masses show central necrosis In a few, the necrotic areas have liquefied in part Cysts are thus formed Diagnosis basal-cell carcinoma

CASE V—No 14790, J J H male, sixty years old weighed 220 pounds, entered the hospital, March 3, 1923, for an ulcer on the left leg Thirty years previous to admission he was burned in an oil explosion The back and legs were burned but the left leg was worse than the right Soon after, the left leg showed contracture at the left popliteal space and since then he experienced an inability to extend the left leg There was no pain present until six months later Efforts to extend the limb oftentimes resulted in the cracking of the scar tissue At the time he reported for treatment an ulcer of the size of a fifty-cent piece (3 x 3 cm) was found at the centre of the scar tissue This ulcer started as a small red papule as large as a dime (1.5 x 1.5 cm) This finally broke down and resulted in ulceration which gradually spread until it reached its present size The ulcer was

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situated just below the popliteal space. The edges were sharply defined, suggestive of syphilis, but the Wassermann test was negative. The history did not mention the presence of enlarged glands. The cicatrix was excised and he had improved. He was discharged on May 7, 1923. He has not been heard of since.

Pathology—The section shows irregular masses of epithelial cells surrounded by connective tissue and cellular infiltration. The cells at the border of these masses are round or oval. Their nuclei stain deeply with hæmatoxylin. The centre cells show signs of degeneration. Epithelial pearls are present. Diagnosis: squamous-cell carcinoma (prickle-cell type).

CASE VI—No B2645, J. T. G., male, fifty-nine years old, reported at the dispensary, September 23, 1923, for a sore on the left leg which he had had for over a year. It was located at the middle of the left leg and measured 3 x 5 cm. The base was irregular and slightly translucent. He had a negative Wassermann. He had been treated with X-ray and the ulcer has healed.

Pathology—Microscopically, the section (Fig. 3) shows strands of epithelial cells which are not very well differentiated extending into the deeper tissues. Here and there are areas of necrosis. No epithelial pearls are present. The nuclei are deeply stained with hæmatoxylin and the outline of the individual cells are not easily made out because of the density of the cell masses. The cells are mostly spindle in shape. Diagnosis: basal-cell carcinoma.



FIG. 7.—Case XV. Squamous-cell carcinoma of the leg arising secondarily to psoriasis. Note the scaly character of the surrounding skin.

CASE VII—No B3365, W. T. U., male, thirty years old, reported at the dispensary, September 27, 1923, for an ulcer over the left tibia. Twenty-five years previous to admission he had a fracture of the left femur. The left leg was placed in a plaster cast for six weeks. Shortly after the removal of the cast the left leg became swollen and an operation was performed for an acute osteomyelitis. Drainage sinuses persisted. At the time he came for treatment there was a granulating ulcer 6 x 8 cm over the left tibia on the medial surface. It contained numerous papillomatous tumor growths up to 2 cm in diameter over the surface. It bled readily. The condition suggested carcinomatous growths superimposed over an old chronic inflammatory condition. There were numerous scars marking the site of old sinuses over the leg. These indicated an old osteomyelitis. He had lost in weight from 150 to 135 pounds. The right inguinal glands were enlarged and pain was present in the right ilio-inguinal region. The left inguinal glands were also enlarged but not tender. He had a negative Wassermann. For a time he was given X-ray treatment. Later, February 4, 1924, amputation at the junction of the middle and upper thirds of the leg was resorted to. He had shown marked improvement with no recurrence (May 1, 1924) when last seen.

Pathology—The microscopic section (Fig. 4) shows irregular masses of epithelial cells surrounded by a scanty amount of connective tissue and cellular infiltration mostly of the small round-cell variety. The epithelial cells are arranged in nests. These nests

are common throughout the section. The cells at the border of the masses are thickly distributed, and the nuclei and protoplasm stain more deeply with hæmatoxylin than those at the centre. Diagnosis: squamous-cell carcinoma (prickle-cell type).

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CASE VIII—No 136, E. G., female, aged twenty, entered the hospital on January 1, 1906. Ten years previous to admission she received a severe burn extending from the upper third of the leg to about the crest of the ilium involving the lower portion of the back. There was also some excoriation on the right thigh. She was confined in bed for two years. In that time the right thigh and the lower portion of the back on the left side down to the gluteal fold entirely healed. The granulating surface remaining was sluggish in cicatrizing and very painful. It never had an offensive discharge till a year previous to admission. At about that time there was discovered a tumor mass distinctly raised from the surrounding skin on the posterior part of the thigh. Examination revealed an extensive grayish tissue typical of carcinoma covering the entire posterior portion of the left thigh. She left the hospital before a positive diagnosis was obtained. In January, 1907, she was readmitted. Examination revealed cicatrization all over the left thigh. Ulcers of the size of a silver dollar (4 x 4 cm.) were located on the posterior and lateral surfaces of the left thigh. Their base was made up of nodular grayish tissue typical of carcinoma. Extensive curettement was performed and was followed by skin graft. She was discharged on May 5, 1907, with the ulcers completely healed. She has not been heard of since.

Pathology—The microscopic section stains blue with hæmatoxylin. Thick epithelial papillæ extend for a long distance into the connective-tissue cells which are cylindrical and stain sharply. Many mitotic figures are seen. Many epithelial pearls are present. The connective tissue surrounding the papillæ are rich in fibroblasts. They also contain scattering mononuclear cells. Diagnosis: squamous-cell carcinoma (prickle-cell type).

CASE IX—No 1603, F. S., female, aged seventy-five, colored, entered the hospital on June 7, 1910. Three years previous to admission a small ulcer was noticed on the outer side of the right thigh (Fig 5). This had steadily increased in size. When she reported for treatment the ulcer had a diameter of about 10 cm. The tumor was raised from the surrounding normal tissue. The edges were fairly regular but the base was uneven with necrotic tissues and sinuses. The discharge was not profuse but purulent and foul. No operation was performed. She died on January 15, 1914. No pathological section was available but the gross picture is apparently typical of carcinoma.

CASE X—No 945, C. L., male, sixty-two years old, entered the hospital, September 9, 1910. About a year previous to admission a lump was noticed on the left groin. This grew slowly and without pain until three months previous to admission when it burst. The mass was cauterized. Examination revealed a mass of the size of a fist (7 x 7 cm.) at the left inguinal flexure. It was cleft deeply in the centre and had a foul sanguino-purulent discharge. Excision and fulguration of the new growth were employed. The patient was discharged but did not improve.

Pathology—The specimen shows numerous cell nests separated by adult connective tissue. The nuclei of the cells that make up these nests show a wide variation in their size and shape and staining qualities. The large, oval, fairly deep-staining ones being in the majority. Mitotic figures are numerous. Epithelial pearls are present. There is some congestion and an enormous amount of leucocytes. There are many large atypical cells (Fig 5). Diagnosis: squamous-cell carcinoma (prickle-cell type).

CASE XI—No 1314, W. W., male, fifty-three years old, entered the hospital on April 27, 1912. Thirty years previous to admission an ulcer had developed at the anterior portion of the left ankle. It never healed. Discharge was constantly present. Five months previous to admission he was traumatized at the left ankle over this sore. As a result the ulcer deepened and the discharge increased. He was treated at the City Hospital. Examination revealed a cauliflower growth involving nearly the whole foot.

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except the toe and heel, and a part of the sole. There was a foul discharge. The inguinal glands were enlarged and suppurating. On July 7, 1912, the leg was amputated at the knee and the inguinal glands were dissected. He left the hospital on August 7, 1912, against the doctor's advice. The patient died soon after, but the exact date and the cause of death were not definitely known. The case had been diagnosed as carcinoma, but the type was not specified and the specimen was not available to me for study.

CASE XII—No 13,694, C W, male, sixty-three years old, entered the hospital on December 12, 1914. Thirty years previous to admission he stepped into some hot grease. The right foot and the lower four inches of the leg were scalded. This healed completely, leaving an extensive scar. About a year previous to admission nodules developed on the scar. Examination revealed several ulcers and nodules typical of carcinoma scattered over the foot. The inguinal glands were enlarged. The right leg was amputated on December 14, 1914. He was discharged on February 19, 1915, with the stump healed.

The microscopic section of the gland showed chronic lymphadenitis without carcinoma metastasis. Section of the tumor was not available, although a diagnosis of carcinoma had been made at the time.

CASE XIII—No 21,365 A M, male, fifty-four years old, entered the hospital, February 23, 1920, for an ulcer on the posterior aspect of the right leg and thigh (Fig 6). He was burned when he was two years old. Forty-seven

years later (five years prior to admission) he noticed that ulceration had started at the site of the old burn. It gradually increased in size. It was not very painful. He had lost ten pounds within the two years previous to admission. The ulcerated area occupied the posterior surface of the lower third of the right thigh, back of the knee, and the upper two-thirds of the leg. The upper medial border showed areas of healing. The edges were raised, undermined, and irregular. The floor was uneven, nodular, and gave a foul discharge. The right inguinal glands were palpable. The ulcer was excised and dressed with dichloramine-T and later was given a skin graft. He had improved when discharged, May 4, 1920. He is now living and well.

Pathology—The section shows irregular masses of squamous epithelial growths surrounded by connective tissue thickly infiltrated with small round cells. Characteristic epithelial pearls are present. The cells at the border are dense, small, not uniform in shape, have deeply staining nuclei, and show more signs of activity in contrast to the cells in the central area. Diagnosis: squamous-cell carcinoma (prickle-cell type). After



FIG 8—Case XVI. Squamous-cell carcinoma of the foot.

the tumor was removed, excessive growth of granulation tissue occurred. The tissue removed showed no recurrence of cancer growth.

CASE XIV—No 24,286, C K, female, eighty-seven years old, entered the hospital, November 15, 1921, for a tumor under the right heel and in the groin. No satisfactory history of the duration of the disease could be obtained. The tumor mass in the heel was excised on December 13, 1921. She was very much improved. She reported for further observation on January 11, 1922. The wound was almost healed. Her daughter believed that the lump in the groin was increasing in size. She died in July, 1923, but the cause of death was uncertain.

Pathology—The specimen is that of a tumor mass measuring 4x5 cm, flat and slightly pedunculated. The greater part of the surface is made up of two ulcers sur-

rounded and separated by gray, opaque skin. On section the tumor is gray, slightly translucent material which is broken up into irregular sized parts by dense fibrous partitions. Some parts show central degeneration. The microscopic section stains blue with hematoxylin. The mass is made up of two kinds of epithelial cells, the round or cuboidal and the spindle. Both of these have deeply staining nuclei. The round or cuboidal cells are mostly arranged in strands separated by very scanty amount of connective tissue. The spindle cells are mostly arranged in globular masses of different sizes surrounded by a scanty amount of connective tissue. No epithelial pearls are present. **Diagnosis** basal-cell carcinoma (?)

CASE XV—No 24,796, P L P, male, fifty-one years old, entered the hospital, February 6, 1922. Twenty years previous to admission he had a



FIG 9—Case XVII. Front view of the legs showing varicose ulcers on the right and squamous cell carcinoma on the left.

small, red, scaly papule on the extensor surface of the forearm near the elbow. It gradually spread all over the upper extremities. Later, it developed on the thigh and spread all over the lower extremities except the sole of the foot. Scales were present. He complained of itching and burning sensation. There was no pain. At times the skin cracked in places. For the last four years prior to admission there had been a growth on the anterior surface of the left leg just below the knee (Fig 7). It measured 2 cm in diameter. It was tender and was covered by a dark crust which was adherent. On the middle third of the thigh, on its lateral aspect, was a new growth 2 cm in diameter. It was raised, ulcerated, and bled readily. It was indurated and tender. The floor had a grayish, slightly granulated opaque appearance. The discharge was offensive. The case was diagnosed clinically as psoriasis with secondary carcinoma. The treatment consisted in cauterization and radium application followed by skin graft. He was very

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much improved when discharged, July 2, 1922. The final result of the treatment was uncertain for the patient has not been heard of since.

Pathology—The microscopic section stains blue with hæmatoxylin. It consists of irregular masses of epithelial cells with dark staining nuclei. The cells at the margin are smaller, more dense, and possess more darkly staining nuclei than those at the centre. Few epithelial pearls are present. Mitotic changes are found mostly among the marginal cells. There is a moderate amount of cellular infiltration. Diagnosis: squamous-cell carcinoma (prickle-cell type).

CASE XVI—No. 254,251, M. W., female, seventy-seven years old, entered the hospital on June 24, 1922. Seven years previous to admission she stepped on a needle. Eight months previous to admission she noticed a sore on the ball of the big toe of the right foot. She had picked the point of the needle out of this sore. Examination revealed a soft plantar verruca about the size of a butter bean (1.5 x 2.5 cm.), (Fig. 8). It bled readily. The lesion was excised on July 5, 1922, and soon after radium was applied. She was discharged on July 21, 1922, when the wound was showing a healthy granulation tissue. After a year she returned with an ulcer on the old scar. Silver nitrate was applied and the ulcer seemed to have improved.

Pathology—A microscopic section of the excised lesion shows dense masses of squamous epithelial cells extending down into the underlying connective tissue. These masses are thick and placed closely together. Dense masses of small round cells fill the tissue about the deeper ends of the invading papillæ. No epithelial pearls are seen. Diagnosis: squamous-cell carcinoma (prickle-cell type).

CASE XVII—No. 26,340, C. L., female, sixty-seven years old, poorly nourished, and poorly developed. She entered the hospital on January 1, 1923, for ulcers on both legs. The ulcer on the right leg was situated anteriorly above the ankle. It had an irregular outline and was diagnosed varicose ulcer. Since about a year previous to admission the ulcer of the left leg had grown more rapidly than ever before. It was an extensive ulceration. On admission it measured 30 x 15 cm. and was situated on the anterior surface. It extended from near the ankle to almost the level of the knee. It had a cauliflower appearance (Fig. 9). The discharge from it was foul. The base was irregular and papillomatous. In some places the base was hard, in other places it was soft. The skin below the knee and down to the ankle had a thin, gray, opaque appearance. The inguinal glands on both sides were enlarged, firm, and discrete. Amputation was performed through the junction of the middle and lower thirds of the left thigh. She was discharged on March 23, 1923. Attempts to locate the woman in order to ascertain subsequent results have proved fruitless.

Pathology—The microscopic section shows dense masses of epithelial cells. At the outer edge the cells are pink and the nuclei stain poorly. Along the inner edge the cells stain deeply with hæmatoxylin. Mitotic changes are present. Numerous epithelial pearls are seen scattered over the epithelial growths. There is a moderate lymphocytic reaction between the epithelial mass and the underlying connective tissue. The skin shows a marked hyperæmia in the neighborhood of the tumor. Diagnosis: squamous-cell carcinoma (prickle-cell type).

SUPPLEMENT

This case is not included in this series, for it came under observation just lately. The importance of the case justifies its being reported. The following are the salient facts about the patient.

J. L., male, fifty-two years old, was admitted to the Out-patient Department of Barnes Hospital, April 12, 1924, for a tumor on the right leg. Fifteen years previous to admission he had an injury on the right leg. Repeated injuries subsequently on the site of the old trauma resulted in the appearance of the tumor one year previous to the

date of admission Examination revealed a cauliflower growth on the right leg It measured 10 x 8 cm It had a purulent foul discharge Varicose veins were present on both legs The inguinal glands were enlarged on both sides The liver was enlarged and presented multiple nodules which in all probability were metastatic There was no pain Jaundice was not evident Up to the writing of this supplement (May 14, 1924), the patient has been under X-ray treatment for the primary growth and the tumor is gradually subsiding

Microscopic Diagnosis—Squamous-cell carcinoma (prickle-cell type)

SUMMARY AND CONCLUSIONS

1 Cutaneous carcinomata of the lower extremities seem to be never a primary condition They arise on an old ulcer or some other lesion

2 They are very rare They comprise not more than 1 per cent of all the carcinomata in the different parts of the body, and 1 to 4 per cent of all the cutaneous carcinomata

3 They are more common in men than in women, at least 2:1

4 They are more common above the age of fifty, but can be found even at an early age of twenty

5 Trauma and burns play a very important part as exciting etiological factors

6 The rôle of syphilis as a predisposing etiological factor in cutaneous carcinomata of the lower extremities is not as yet fully established

7 Varicose veins and varicose ulcers are not the most important predisposing factor in the etiology of most of the cutaneous carcinomata of the lower extremities

8 Cutaneous carcinomata of the lower extremities produce metastasis in the inguinal glands, either on the corresponding side alone or apparently on both sides, but mostly the former Metastasis takes place early in some and late in others

9 In cutaneous carcinomata of the lower extremities arising from trauma, the interval elapsing between the infliction of the injury and the appearance of the tumor varies from three months to fifty-four years

10 Most of the cutaneous carcinomata of the lower extremities are of the squamous-cell variety (prickle-cell type)

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SOME BIOLOGIC EVIDENCE OBTAINED FROM A STUDY OF CONGENITAL DISLOCATION OF HIPS IN IDENTICAL TWINS SUPPORTING THE DEVELOPMENTAL THEORY

By KELLEY HALE, M D
OF WILMINGTON, OHIO

THE development of the etiology of congenital hip dislocation has hardly kept pace with that of treatment. While the theories have developed along two main lines, that is, developmental and mechanical, after all there remains but a narrow chasm between them.

If the acetabulum does not develop sufficiently to hold the head, dislocation results and we have the normal mechanical balance upset with lack of development of the head. On the other hand, one can see that an over-development of muscular power about the hip could bring about a dislocation. There is no better demonstration of fact that the wonderful symmetry and power of our bodies is absolutely dependent upon growth coupled with definite strains, stresses and mechanical functions, than is shown in congenital dislocation of the hip.



FIG 1—Early stages of twin chicks developing from single ovum

That eighty-eight per cent of congenital dislocation of hips are found in girls is an extraordinary fact. I can not believe that trauma, either internal or external, can account for it. Or that women being of the more primitive type are naturally more subject to congenital accidents. One might be led to conclude that there is some fundamental difference between the hips and pelves of male and female *in utero*. Girls have practiced hyperflexion of the hip in dancing for countless generations. This is a mere suggestion. I believe in Lamarck's theory of the transmission of acquired characters. Congenital hips show a marked hereditary factor.

I had the opportunity in 1922 of reducing congenital hips in identical twins. Before reporting them I wish to say a few words about the biology of identical twins as a basis for our observations.

By identical twins we mean duplicate twins of the same sex and identical

CONGENITAL DISLOCATION OF HIPs IN TWINS

features It is proven that they develop from a single ovum Reference to Fig 1 shows two chick embryos developing from a single egg I discovered this specimen in 1915 There is a sharp line of demarcation at right angles to the main axis of the embryos passing between the head folds which are together, thence through the pellucid and opaque areas The embryos seem to face one another

In the transparent eggs of the common water snail, *Lymnaea stagnalis*, I have often observed twins developing, also odd numbers up to seventeen in a single egg Figure 2 shows the early stage (gastula) of a Siamese snail Figure 3, the same at hatching time In the armadillo twinning is a normal process and has been studied extensively by Neuman

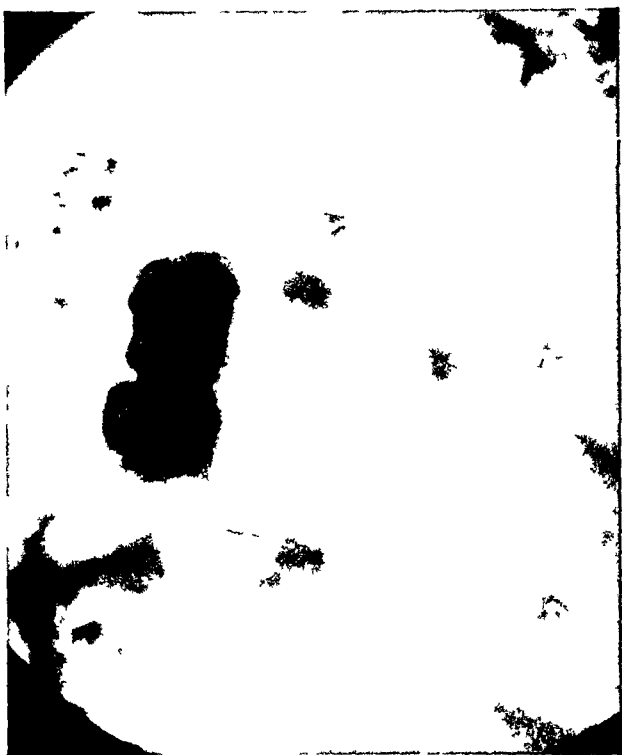


FIG 2 —Early stage of Siamese twin snail

Another fact in regard to identical twins is that peculiar integumentary phenomena of mirroring That is the finger or toe print may have an exact mirror image of the corresponding member In the cases that

I will report we find in addition to integumentary mirroring, mirroring of some mesodermal structures, also a habit mirroring as sucking of opposite thumbs at night

The following case is herewith reported

Miriam B, and Madeline B, females, white aged four, identical twins, were brought to my hospital, April 26, 1922

The patients mother gave the history that the twins were born at normal delivery, no forceps being used and that the mother suffered no injuries during gestation



FIG 3 —Siamese twin snails about hatching time

The twins did not try to take a step until they were twenty-three months old although they were encouraged to do so To this time nothing abnormal had been noticed about the

twins Both were very reluctant to perform the function of walking and soon the mother noticed that one child dragged her right leg and the other the left leg

Both twins complained more or less with pain in their backs and their lameness gradually became more emphasized In April, 1922, the children were brought to an Orthopaedic Clinic which was held at Wilmington, Ohio Doctor Stemfeldt, of Columbus, the examining physician, diagnosed congenital dislocation of the right hip in one twin and of the left in the other, and advised them to submit to immediate treatment for the correction of the condition The same day X-ray examination at my hospital confirmed the diagnosis of Doctor Stemfeldt

Precious History, etc—The habits of both have been regular, sleep well, appetites only fairly good, and bowels regular Both have had tonsillitis and the one with the left congenital dislocation of the hip has had pneumonia Neither have had any other illness or injuries

Family History—Does not reveal anything relevant to the case Both

parents are living and in good health, also two sisters are living and in good health No deformities Maternal and paternal grandfathers died of tuberculosis No cancer in the family No cases of congenital dislocation of hips in the family

Physical Examination—The twins so closely resemble one another that it is impossible for the nurses to distinguish them Only the mother can be positively sure of the identity of each They are both about thirty-six inches tall and weigh $24\frac{1}{2}$ and 24 pounds, respectively They have light brown hair, blue eyes, and clear complexions Madeline, Fig 4, with the left dislocation has a small hæmangioma on top of her left shoulder and internal strabismus of the right eye and sucks her right thumb, the other, Miriam, Fig 5 having internal strabismus of the left eye and sucks her left thumb Both are right handed They have no other deformities Heart, liver and lungs normal Stomach, abdomen, intestines normal All other systems normal

Fluoroscopic examinations made of the patients do not reveal transposition of any of the viscera of the thorax and abdomen

Careful examination of the finger prints showed a striking similarity in the respective



FIG 4—Congenital dislocation of left hip associated with right internal strabismus

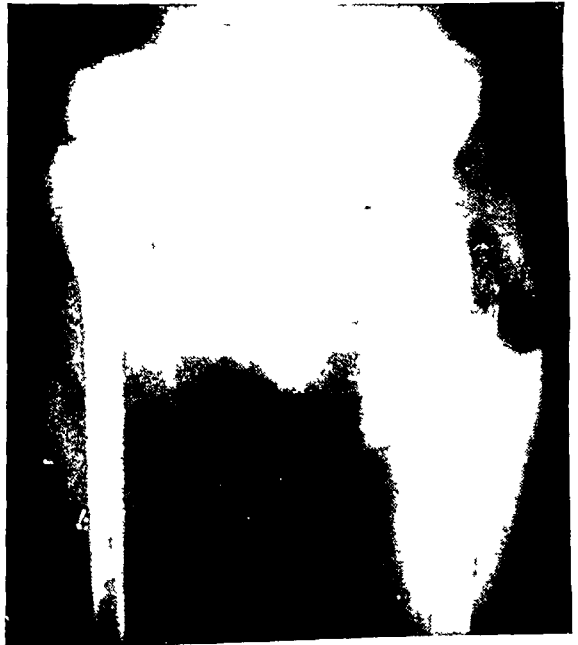


FIG 5—Congenital dislocation of right hip associated with left internal strabismus

CONGENITAL DISLOCATION OF HIPS IN TWINS

hands, but there was no mirroring of the index fingers as often occurs in monozygotic twins. Study of the toe prints revealed a symmetry reversal or mirroring of the prints of the left great toes. Neuman states that identity in friction ridge patterns of twins makes their monozygotic origin very highly probable.

These patients entered my hospital, May 8, 1922, and submitted to the following treatment:

The patients were given a general anæsthetic of ether in order to reduce the dislocations. The heads of the femurs could be placed readily in the socket and by abduction the adductor muscles were thoroughly kneaded and stretched. Both limbs were placed in plaster cases after being flexed and abducted. The cases were placed around the waist and hips down to the tips of the toes over a union suit. The sacrum, hips and knees were thoroughly padded before applying the cases.

X-ray examination in a few days showed that Miriam's right femur had slipped out of the acetabulum either during application or after application of the case. This was probably fortunate in a way as it brought about stretching of the adductor muscles so that when a second case was placed, the muscles could be entirely abducted and with both limbs in position, the case was put on. X-ray examination the same afternoon revealed that the head of the femur was in the acetabulum.

After spending thirteen days in the hospital, the patients were sent home for two and a half months, during which time they were to spend most of their time out of doors in the sunshine. They were directed to return to the hospital at the expiration of this period.

July 24, 1922, the patients returned. After first making X-ray examinations of them in the cases to determine that the heads of the femurs were still in the acetabulums, the cases were removed by Doctors Tribbet and Ruble and the patients given a thorough cleansing. Under general anæsthesia of ether the affected limbs, respectively, were extended and rotated inward. Cases were applied in this position encircling the pelvis and abdomen up to the umbilicus. The unaffected limbs remained free.

Subsequent X-ray examinations revealed the fact that the heads of the femurs were still in the acetabulums.

After spending four days in the hospital in order that the patients might become accustomed to their cases with their limbs in the new position, they were sent home for ten weeks to spend the major portion of the time out of doors and to have nourishing food, etc.

The patients returned October 9, 1922, and the cases were removed. X-ray examinations revealed excellent results in both cases.

I think that from a study of these two patients we can arrive at the following brief conclusions: 1. That they were monozygotic twins. 2. The congenital dislocations in these patients were developmental in origin, not traumatic for the following reasons (because I think these facts are associated): (a) Mirroring of left great toes. (b) Mirroring of internal strabismus of right and left eyes. (c) Habit mirroring, that is, sucking opposite thumbs during sleep. (d) Mirroring of dislocations. 3. Multiple pregnancy as a causative factor has to be considered, but it would indeed be a strange coincidence to have these dislocations occur as they did from a mere mechanical force. 4. Mirroring of structures other than integument has not been noted before as far as I can learn.

ACUTE OSTEOMYELITIS IN CHILDREN*

BY CHARLES E. FARR, M.D.

OF NEW YORK, N. Y.

ACUTE osteomyelitis is generally considered to be a blood-born infection in the marrow of the long bones. Most surgeons believe the condition is one of septicæmia followed by pyæmic manifestations in the bone and is comparable to abscess in the lungs, liver, or kidney. The usual causative agents are the pus-producing organisms, staphylococcus, and streptococcus, but occasionally others are found.

Much has been written as to the portal of entry for these organisms, but nothing definite has been established. The staphylococcus is the most common invader, and this is found of course universally in the skin, but not so commonly in the mouth and intestinal tract. Many cases of acute osteomyelitis can be traced fairly definitely to furuncles, and some to preceding tonsillitis and gastro-enteritis. The question of a specificity of these pus organisms for bone lesions or the sensitization of these bones for the specific organism, is one of the most interesting problems still awaiting solution.

Theoretically every case of acute osteomyelitis should give a positive blood culture at some stage in the disease. Practically it is quite difficult to recover the organism, just as it is in pneumonia, typhoid fever, and other bacteræmias.

The relationship of trauma to osteomyelitis is very interesting and a much controverted point. There is a general impression that a local trauma in some mysterious way causes bacteria to pass into the bone and produce an osteomyelitis. It requires but little thought to show that this can hardly be true. Even if the skin and soft tissues are extensively lacerated, and the bone exposed, true osteomyelitis rarely develops. In fact, any compound fracture may result in a form of osteomyelitis, but rarely with the clinical picture of the disease as seen in the spontaneous type.

The belief in trauma as an etiological factor will not bear close scrutiny. The history is nearly always of a slight blow or fall with almost immediate symptoms of disability accompanied by fever, swelling, and great pain. On analysis this will usually prove that the osteomyelitis began at this time with such sudden onset as to cause the child to cry out with pain, and even to fall.

Although our records will give a history of trauma in about one-third of the cases, in no instance has there been local evidence of trauma of the skin or of the soft parts. Moreover the infection always starts within the bone and very often in that part of the bone most protected from trauma, and farthest removed from the alleged trauma. The rarity of infection of simple closed fractures, the ideal setting for osteomyelitis according to the trauma theory, is another strong negative argument.

* Read before the Springfield Academy of Medicine, September 9, 1924.

ACUTE OSTEOMYELITIS IN CHILDREN

Slight blows and sprains of the extremities without visible findings of injury and with negative X-ray findings have been advocated by some as the underlying cause of osteomyelitis. In rebuttal it can only be stated that this is purely theoretical, that no proof can be adduced which will pass critical examination and that the multiplicity of such injuries in every normal active child would negative their importance as etiological factors.

Certainly in the great majority of cases there is no history of injury and no probability of it. As we do not include trauma as one of the usual causes of abscess of the lungs, liver, and kidney, it hardly seems rational to insist upon it as the cause of a similar condition in bone.

The obvious reason for the selection of the long bones in growing children is the slow blood current in the tortuous channels at the ends of the bones. These channels are narrow, tortuous, and inelastic, the ideal locus for any small embolus to lodge in. It is also possible that large emboli at times block the larger vessels of the long bones.

This again is purely surmise, as naturally enough no proof can be adduced.

Animal experiments have shown it difficult to produce osteomyelitis without trauma, but the conditions are quite different. If one could use very young animals, and those especially susceptible to staphylococcus, and employ the sensitized germ which has already produced osteomyelitis in the human, the result of animal experiments would be more trustworthy.

The pathology of acute osteomyelitis is exactly that of any other acute infection with the additional factor of the bone involvement. The stages of inflammation, congestion, exudation, infiltration, death of tissue, suppuration, sloughing, sequestration, and healing are all present. The symptoms are more severe at the onset because of the dense bone envelope. The process in its chronic stage is more prolonged because of the slow healing power and difficulty in casting off sloughs.

The symptomatology is that of any severe infection, with fever, chills, rapid pulse, delirium and prostration in the more severe cases. Locally there is pain which is usually severe, considerable heat, redness, swelling, and loss of function.

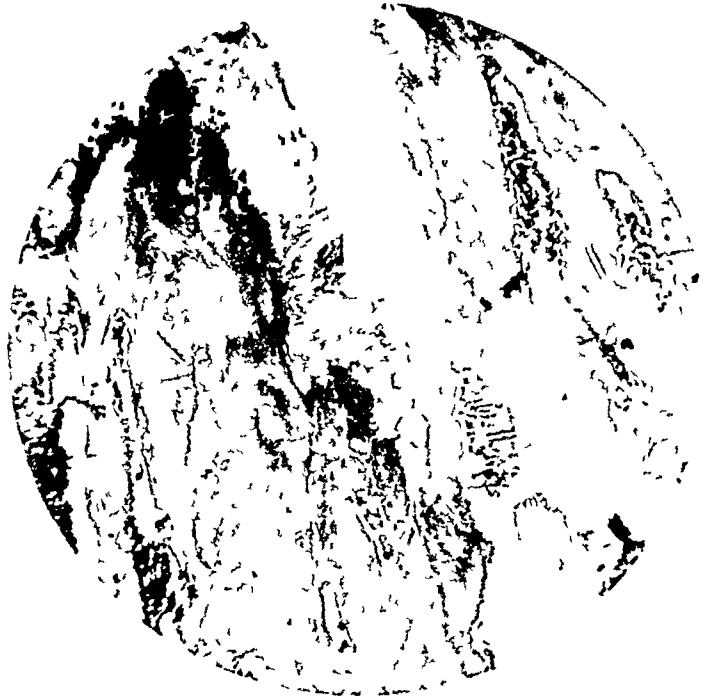


FIG. 1—Acute osteomyelitis of tibia, low power

The differential diagnosis is by no means easy. Acute articular rheumatism is a most common diagnosis where osteomyelitis is the real cause. A careful study of the history and of the physical findings will always rule out rheumatism in the more severe types of infection. In the milder cases it is sometimes necessary to await events. The leucocyte and the differential counts in osteomyelitis are usually high, but this will not serve to differentiate the condition from any other infection. Our counts have ranged from 10,000

to 60,000, the average being around 20,000, with an average polymorphonuclear of 80 per cent.

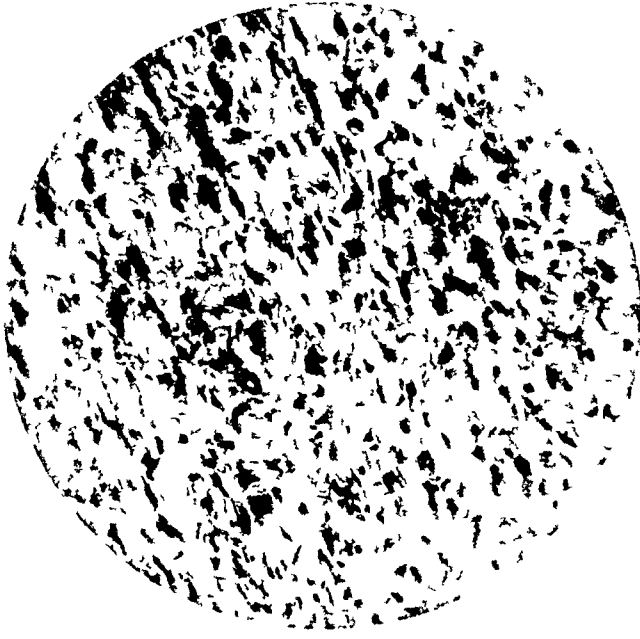


FIG. 2.—Osteomyelitis of tibia, high power

Oddly enough while physicians occasionally mistake these cases for rheumatism, the surgeon not uncommonly mistakes them for injury. This is due to hurried, careless examination. The story of injury and the swollen extremity are the only two factors pointing to fracture. The exquisite tenderness, the redness with local heat, the increase in temperature,

the high blood count and differential, the rapid pulse with prostration, should be sufficient to establish the correct diagnosis at once. Syphilis, tuberculosis, rickets and scurvy, are to be thought of in the milder cases. The differential diagnosis is not always easy, and again this depends upon careful study. X-rays in acute osteomyelitis are of practically no value until the tenth day. In the meantime if one waits for this evidence irreparable damage will be done. The X-ray should be taken as a guide in the progress of the disease, but no reliance can be placed on a negative film.

For the purpose of classification and of treatment, osteomyelitis is divided into several types. We distinguish between fulminating, severe acute, acute, and the mild types. This of course is based entirely on the surgeon's judgment of the severity of the case, but is useful to determine treatment, and for prognosis. The fulminating cases probably can never be saved. The patient is overwhelmed from the very onset with extreme toxæmia, and usually dies about the time of the appearance of the first local signs in the bones. No form of treatment seems of any avail. We all strive, however, to locate the first bone lesion, and drain it.

ACUTE OSTEOMYELITIS IN CHILDREN

The severe acute cases are those with high temperature, great prostration, and slight, but definite local signs. In these a simple drainage operation is performed, cutting through the soft parts, separating the periosteum and occasionally entering the bone proper. More often the bone is left alone, the wound is packed open for from twelve to twenty-four hours, and later the marrow is exposed. At the original operation a considerable amount of serum and sero-pus is found around the bone. This has seeped through along the metaphyseal line, and the perforation can often be felt. The temptation to more radical surgery is great, but results are very often disastrous. The condition is not unlike severe spreading peritonitis, where the simplest possible drainage operation is most successful.

The ordinary acute case of osteomyelitis with temperature of 102° F, moderately rapid pulse, slight prostration, and marked local reaction, can safely be treated more radically. The bone is freely exposed, the cortex is chiseled away, and the marrow uncovered. It is not wise to prolong the operation, nor to curette or disturb the marrow in any way. Here results of



FIG 3—Old osteomyelitis of the left femur showing one and one-half-inch lengthening

surgery depend largely on the judgment of the operator in not going too far. Little children with such severe infections are easily shocked, and the immediate post-operative mortality is high where radical surgery is attempted.

It should always be borne in mind that children have great healing power and that simple drainage is often sufficient without radical measures. Treatment by total osteotomy has been advocated and tried, but it is needlessly severe, and not particularly successful in its immediate or remote results.

Finally there are mild types of acute osteomyelitis with little or no systemic reaction, and but moderate local signs. These can be treated by fairly radical excision of the focus with excellent results in experienced hands.

The after-treatment of cases of osteomyelitis requires great patience and

attention to detail. Simple cleansing with very mild antiseptics, preferably Dakin's solution, is the most effective method. Dressings should be frequent and the skin should be kept clean. Splints must be used if the bone is greatly weakened. No special general or local medicaments have proved of any use. Blood transfusion is of great value in the anæmia which so constantly follows general sepsis. Various forms of light therapy are also useful for general



FIG. 4 —Old osteomyelitis of head of the femur with dislocation

tonic and healing effect. Needless to say fresh air, sunlight, and good food are as efficient here as in any other state of lowered vitality.

The complications of acute osteomyelitis are really extensions of the original process into the neighboring parts, especially in the soft parts, and the joints, or by means of the blood stream into the internal organs, particularly the liver and lungs. One should always be on guard against extension along the shaft in the marrow, especially into the adjacent joint. This can be recognized by increased temperature, swelling, local heat, and pain. Free drainage and active motion will result in excellent function, even in this desperate condition.

The period of disability in osteomyelitis is very long. Healing may occur in three months, or three years, or never. It depends on the location of the principal lesion, and upon the thoroughness with which it can be treated. Relapses are common even after many years.

The end results as regards function are of interest. If the epiphysis has been severely damaged there will be shortening and deformity. Occasionally

ACUTE OSTEOMYELITIS IN CHILDREN

the epiphysis seems to be stimulated by the infection and overgrowth takes place. One of our cases of this type has an inch lengthening of the femur.

In the case of paired bones, the altered growth of one becomes a serious matter in the function of the adjacent joints. This is true also where one condyle is involved more than the other. The resulting valgus, or varus, is very difficult to control. Splints and braces are tried, and corrective operations must be resorted to in the more pronounced cases.

In younger children the power to digest soft bone and to replace dead bone by living is very great. Many of our cases show large sequestra early in the disease, but later these are surrounded by involucrum and very frequently are absorbed and replaced by new bone. These new-formed shafts of the long bones are never quite normal, but they serve their purpose well.

At St. Mary's Free Hospital for Children

during the years 1914 to 1924 there have been 98 cases of acute osteomyelitis, divided as follows:

Femur	20	Radius	5
Fibula	14	Multiple	10
Mandible	11	Fibula	3
Humerus	9	Rib	5
Tarsus	5	Ulna	2
Crumum	4	Scapula	1
Os calcis	4	Clavicle	1
Metacarpals	4		

Of these 58 were boys and 40 were girls. There were six deaths, or slightly over 6 per cent. Two were discharged as unimproved, 90 were considered improved or cured, this depending entirely on the optimism of the House Surgeon.



FIG. 5.—Osteomyelitis of the os calcis with marked destruction of bone.

CHARLES E FARR

Many records were incomplete because of war conditions The following data are as accurate as careful study can make them

Number of cases giving definite history of injury, 20

Number of cases giving doubtful history of injury, 35

Those giving no history of injury, 43

In no single case was any physical evidence of injury found

Only 43 cultures are recorded in the charts Of these there are 26 for staphylococcus aureus, 5 staphylococcus and streptococcus, 4 staphylococcus albus, 1 streptococcus, 2 pneumococcus, 1 streptococcus and staphylococcus and diphtheroid, 4 were reported as sterile or no growth, 4 only gave positive blood cultures according to the records Of these two died and two recovered

CONCLUSIONS

1 Acute osteomyelitis in children is a manifestation of septicæmia with pyæmic abscesses in the bones

2 The portal of entry for these organisms is frequently the skin

3 The probable underlying cause is a state of lowered vitality and resistance to infection

4 Local trauma plays a minor if any role in the causation

5 Early recognition and drainage will save a large proportion of the cases

6 As in all other infections the general resistance of the patient and the virulence of the invading organism are the two essential factors

RECONSTRUCTION OF HIP-JOINT DISORGANIZED BY CHARCOT'S DISEASE

By JOSEPH P. HOGUET, M.D.
OF NEW YORK, N. Y.

CHARCOT'S disease or tabetic arthropathy is not a rare condition and most frequently occurs in the joints of the lower limbs. The knee is most commonly involved and the hip-joint next in frequency. Platow, quoted by Whitman, reports sixty cases in the knee, thirty-eight in the hip, thirty in the foot and twenty-seven in the shoulder.

This condition may occur as a simple chronic synovitis or more usually as a destructive osteoarthritis with erosion of the joint cartilage and bone, hypertrophy of the synovia and irregular formation of bone and cartilage around the periphery of the joint. Pathological fractures of the bones of the joint frequently occur on account of the destruction of bony substance and in these cases non-union is practically always seen. Anti-syphilitic treatment has often been found to be of little benefit in these conditions.

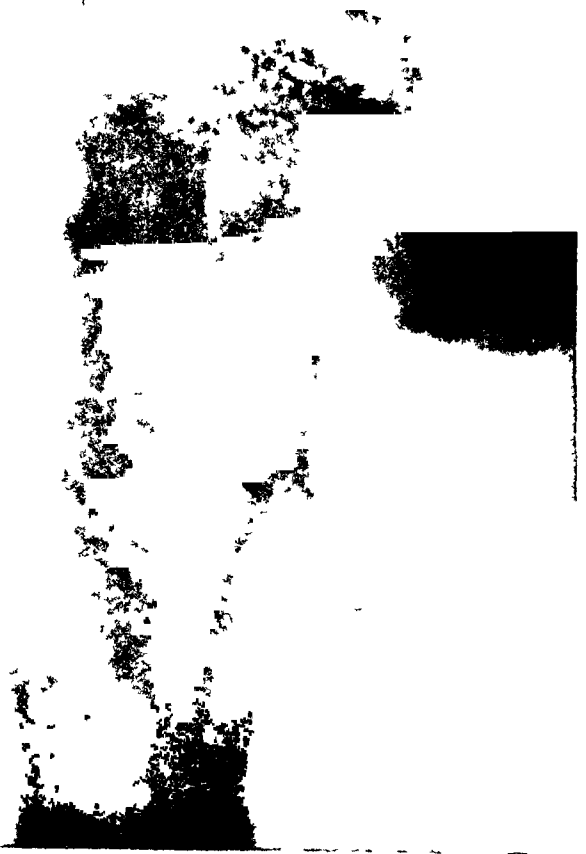


FIG. 1.—Condition of hip-joint found immediately after sudden development of disability. December 17, 1923.

The following case has been thought to be of sufficient interest to be reported for the reason that, as far as the writer knows, this is the first case of Charcot's disease of the hip to be treated by the reconstruction operation of Royal Whitman. Up to the present time, these cases have been given no relief except by a hip brace and have only been able to get about with the greatest difficulty. The reconstruction operation is the only one suitable for a Charcot hip and judging from this case is the only kind of a procedure which can make a strong, movable, serviceable joint.

Another important point is that, in this case, there was practically complete destruction of the neck of the femur up to its junction with the shaft. The head was distorted in shape, as can be seen in the photograph, and all the articular cartilage on its upper surface had disappeared. Radiographs taken during the last two years show that the disease has not progressed and that it has not extended into the shaft. The great trochanter which had been cut away and fastened into the shaft lower down is still solidly in place. The irregular new bone formation has not progressed and apparently the disease is at a standstill. Few of these arthropathies have ever been operated upon,

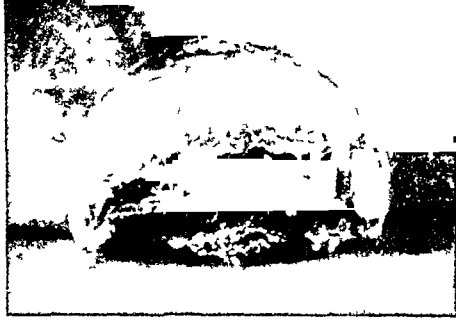


FIG 2—Head of femur found loose in acetabulum showing flattening and loss of articular cartilage

so that it is very difficult to foretell what will happen in these cases. In this patient the reconstruction operation was done as a last resort and it was not known what the outcome would be. As it did result so favorably, it may be possible to resect some of the early cases of Charcot knees and, possibly, with a large inlay graft, to secure bony union between the femur and tibia.

N S is a Russian and at the time of the operation was twenty-nine years of age. Except for an attack of typhoid fever and bronchopneumonia in his youth, he was perfectly well until 1913, when he contracted syphilis. For this he was actively treated in Moscow for seven months and for another four months in Texas. He had no further anti-syphilitic treatment until 1916 when, although he had a negative blood Wassermann, treatment was resumed and continuously carried on until December, 1921. Early in 1922, he found that he was becoming more and more nervous, he had occasional attacks of hysteria and of hallucinations and failure of memory. He had no headaches, but seemed to have poor control of his legs to a certain extent, so that he was afraid to climb stairs or walk on uneven surfaces. Treatment was then resumed with mercury and iodides.

On April 8, 1922, in Berlin, he was struck by an automobile. He was brought to a sanatorium where he was found to have a cerebral concussion, but no fractured skull. At this time a spinal tap was done and he was found to have a positive Wassermann in the spinal fluid. For the following eight weeks he was treated by injections of serum from patients with malaria with a marked improvement in his mental condition. His nervousness and irritability improved continuously, so that he resumed his work in August, 1922.

He came to the United States in October, 1923, and in December of that year noticed a swelling of the right hip-joint, for which he was referred to the writer on the tenth of that month. On examination, at that time, a moderate swelling of the right hip-joint was found, but motion was free and only slightly painful. He remained off his feet for a few days and the condition rapidly improved, so that he resumed his work as a salesman. On December 17, 1923, while walking, he suddenly felt his hip give way and fell to the ground. He was removed to his home in a taxicab and from there was brought to the Ruptured and Crippled Hospital. On his entrance there, he was found to have the typical deformity of a fractured neck of the femur, which was demonstrated in the radiograph (Fig 1).

He was operated on December 28, 1923. On cutting down on the neck of the femur, a fracture with a great deal of destruction of the neck was found and the whole joint was filled with a sandy material that could be scooped out with the fingers. The deformed

head of the femur was found loose in the acetabulum, the ligamentum teres having disappeared. The head was found to be oval, with a great deal of flattening on the upper surface, which was rough and uncovered with cartilage (Fig 2).

The great trochanter with the gluteal muscles attached was cut off obliquely from the shaft and the upper end of the femur smoothed off so that it would fit into the acetabulum. The great trochanter was then brought down and fastened to the outer surface of the shaft of the femur about three inches below with two beef bone screws while the limb was held in wide abduction. The wound was closed without drainage and the leg held in wide abduction by a plaster-of-Paris spica.

The patient made a very good post-operative recovery and the plaster was removed at the end of the fourth week. It was then found that he had an extremely good range of passive motion, but with the hand over the joint a peculiar grating was felt. There was less than one inch of shortening in the leg. He remained in bed without plaster for another two weeks and was then allowed up on two crutches. A radiograph taken at that time showed the new head of the bone in good position in the acetabulum and a great deal of new bone formation in the new joint, which accounted for the grating sensation. He then left the hospital, and for a full year was actively treated with anti-syphilitics during all of which time the blood Wassermann was negative.

His general condition improved slowly and the range of motion in the hip became greater. He discarded one crutch at the end of six months and the other at the end of a year, but still continues to use a cane, as he has not regained perfect confidence in the new joint.

He was last examined on December 17, 1925, when his general condition was found to be excellent, although his weight had not increased very much. He now uses a cane only when out of doors. There was slightly more than one inch of shortening in the right leg. Active and passive motion in the hip were practically normal, although there was a slight muscular atrophy in the muscles above and below the knee. The grating sensation in the joint had almost disappeared. His nervousness and irritability had gone and he said that he was capable of very good mental work. A radiograph, taken at that time (Fig 3), showed the same formation of new bone, but that the disease had not progressed further down the shaft of the bone.



FIG 3—Radiograph taken December 17, 1925

UNUNITED FRACTURE OF THE HIP*

By MELVIN S. HENDERSON, M.D.

OF ROCHESTER, MINN.

FROM THE SECTION ON ORTHOPEDIC SURGERY, MAYO CLINIC

THE teaching that non-union is expected to follow a fracture of the neck of the femur is now definitely relegated to the past. Undoubtedly such fractures are better treated than they were formerly, owing largely

to the writings and the teachings of Whitman, who has persistently advocated the abduction method. Nevertheless, we still see too many people with non-union of the neck of the femur dragging themselves about, lame, disabled, and suffering great pain and discomfort. Impetus was given to renewed interest in non-union of the hip by the bone-grafting operation, introduced fifteen years ago. A review of the cases of old fracture of the hip which have been seen in the Mayo

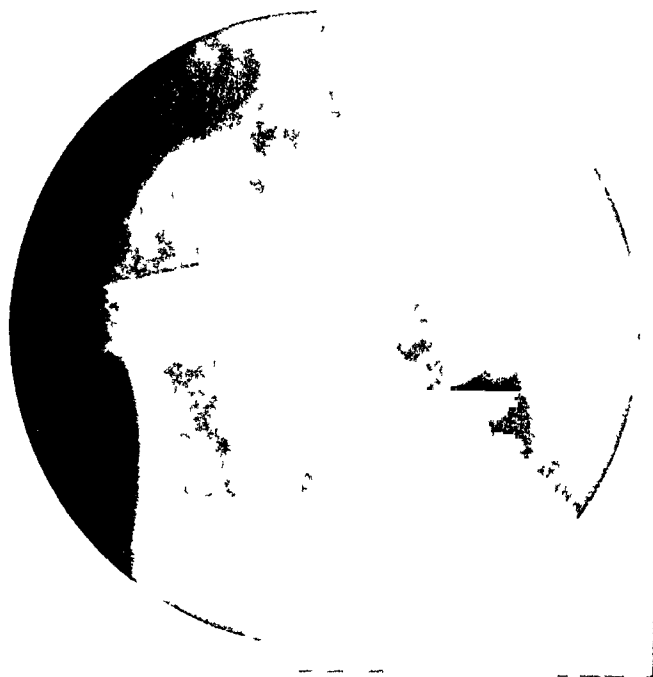


FIG. 1.—Successful bone graft for non-union of more than three years duration. Note partial restoration of the neck of the femur.

Clinic during the last six years, 1919 to 1925, inclusive, will be presented in this paper, with the object of evaluating the different procedures employed to relieve the patients.

Selection of Cases—Non-union of the hip does not in itself demand surgical interference. There is no reason to subject elderly persons to the risk and confinement accompanying operation when they have comparatively little discomfort and can get about with a cane or crutch well enough to accomplish satisfactorily the social and business activities incident to the declining years of life. Also, certain younger persons who would be excellent surgical risks have fibrous union of such strength that function is remarkably good. I recently encountered an example of this in a coal miner, aged forty-five, who had a limp and occasional soreness in the leg but no pain, and was able to carry on his work efficiently in spite of the fact that roentgenograms

* Read before the Minnesota Academy of Medicine, Minneapolis, March 10, 1926

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taken five years after the accident showed typical pseudoarthrosis. Obviously there was no reason to subject him to an operation. Therefore, the patients who require operation are those who are not too old and are seriously disabled, or older ones who are equally disabled but have an expectancy that will warrant the risk and expenditure of time incident to operations of this kind. Certain older patients whose pain and discomfort are so great that they are anxious for relief are nevertheless entitled to their opportunity and may

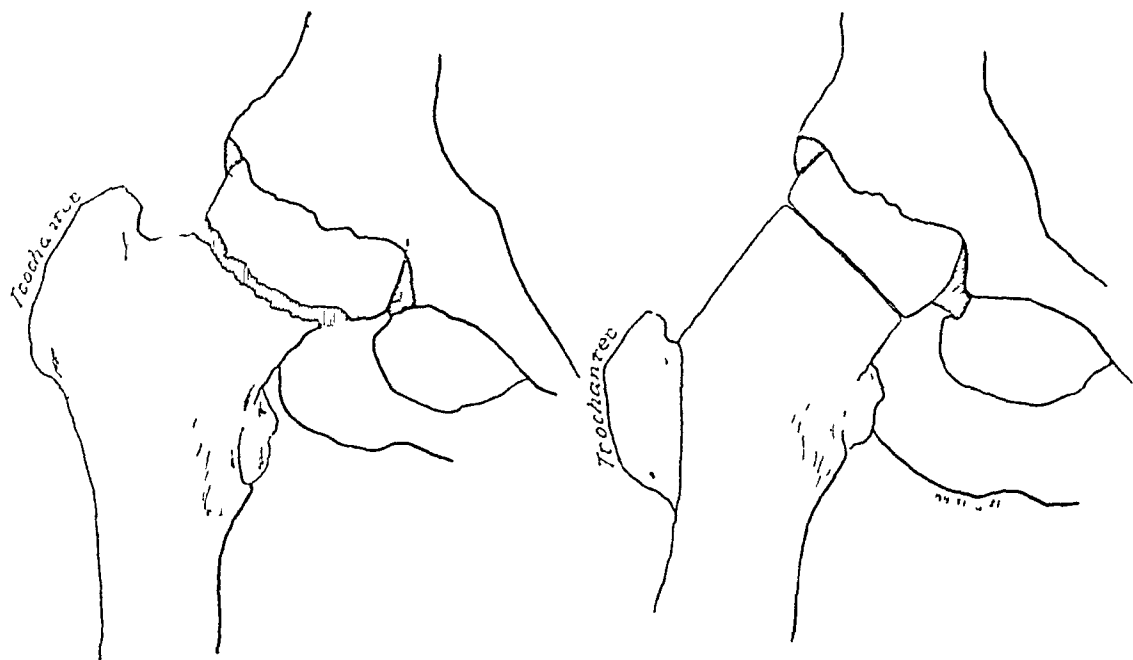


FIG. 2.—Reconstructed neck placed against the head of the femur

be operated on after careful and frank consideration even though they are not Grade 1 risks.

Types of Operation—The various types of operation have been described as reconstruction operations, the actual reconstruction being in proportion to the loss of substance of the neck and the viability of the head. I believe that the head is rarely dead, although this is often given as the reason for demanding its removal and as an argument against the bone-grafting operation. The blood supply to the head is poor and the cartilage obtains most of its nourishment from the synovial fluid. The vessels accompanying the ligamentum teres carry the blood to the bone in children, but there is some question as to how much these vessels nourish the head of the femur in adults.

The operation of choice is undoubtedly that wherein one exposes the fracture, freshens the fragments, carefully reshapes the ends, so that they fit accurately, and after drilling a hole through the trochanter, remnant of neck and well into the head, drives an autogenous bone graft firmly into the channel as a peg for fixation and a physiologic stimulation to the formation of bone (Fig. 1). Care must be taken to see that the head is really freshened, and that the freshened end of the neck is held firmly and accurately with broad contact against the denuded head. In all the cases reported in this series wherein the bone graft was used the fibula was employed. The graft is taken

from the lower half of the fibula, about 7 or 8 cm above the tip of the malleolus, and consists of about 8 or 9 cm of the bone in its entire thickness. Before driving it into the channel prepared for it, one end is slightly pointed and all the muscle and as much of the periosteum as possible are stripped off. No inconvenience is caused the patient by the loss of bone, although the gap in the fibula never fills in. If the patient were to fracture the tibia later, it might be a complication in setting the leg. The patient is always told of its removal and that in that area there is but one bone left. Such a graft is a

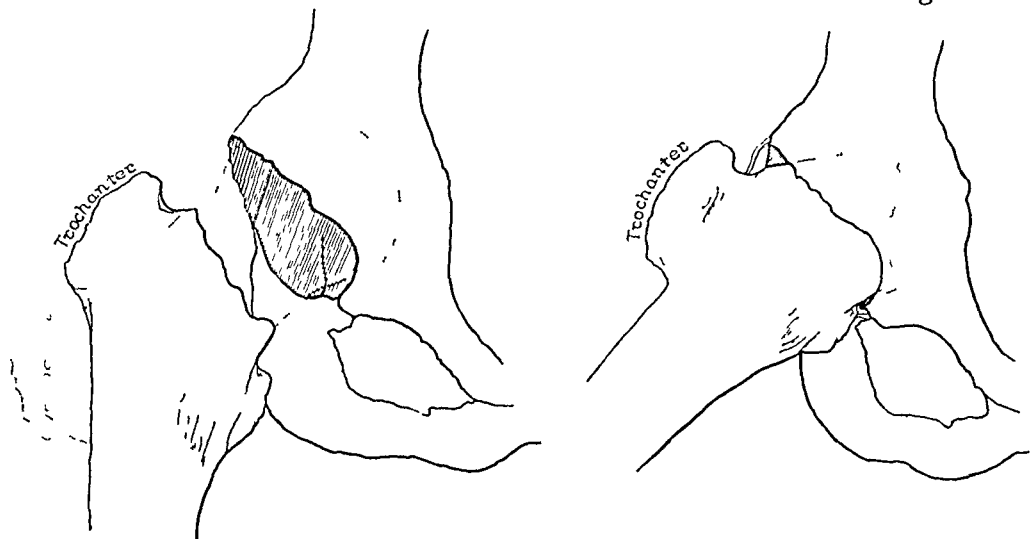


FIG 3—Head removed and reconstructed neck placed in acetabulum. Trochanter moved down.

large strong peg, with its use our results have been better and it is at least one improvement in our technic that I believe is partially responsible for our increased percentage of cures. I am confident that most of our poor results have been due to the fact that broad, firm contact between the neck and head has not been obtained and thus a gap was left with only the bone graft to bridge it. Under these conditions the graft slowly weakens in the part bridging the gap and the regenerative properties of the head and neck of the femur, bathed as they are in synovial fluid, are insufficient to bring about union. The final picture is a fracture of the graft, in other words, non-union. This particular type of operation is a difficult one and not to be undertaken lightly. Even under the best conditions of exposure, careful apposition of the fracture surfaces is not easy and taxes the ingenuity of the surgeon.

Generally speaking, the autogenous bone-peg should only be used when a fair amount of the neck of the femur is left. Often it is concluded that there is no neck left because little shows in the roentgenogram. If it is taken with the leg rotated outward, the neck is looking directly anterior and casts no shadow, therefore, care must be taken to have the foot held upright, or, better still, rotated slightly inward, for it is only in this position that the neck will cast a shadow which gives a fair estimate of its size. In certain cases of this series beef-bone screws were used for fixation, after the neck and head

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were carefully prepared. It was found in a previous series that they are not as suitable as the autogenous graft, as they are absorbed more quickly and do not stimulate the formation of bone. They have not been used in the clinic during the last few years, although they have a definite place in the treatment of fresh fractures.

When the neck has been absorbed, Brackett's operation is an excellent procedure if the patient is young enough and providing at operation the head is found to be not devitalized or necrotic. A good portion of the trochanter with its attached muscles is lifted up, and a new neck is made, freshened, and carefully fitted to the reshaped head of the femur, and the hip abducted. The trochanter is then fastened to a new area which has been carefully freshened on the femur at a lower level and the leg put up in plaster well in abduction (Fig 2).

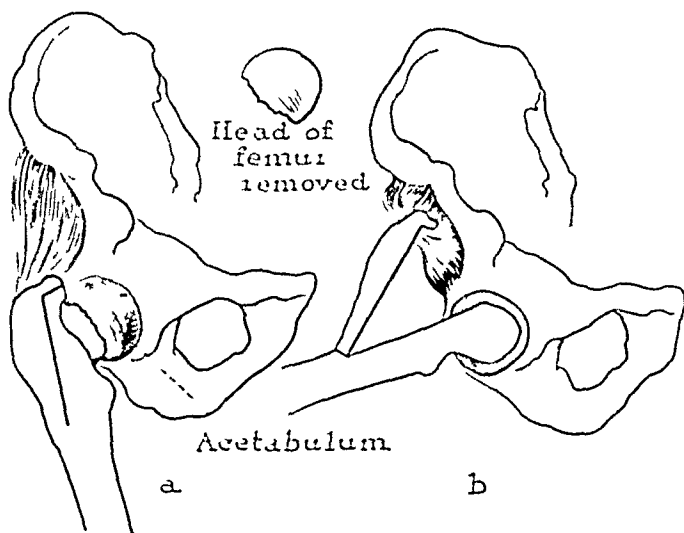


FIG 1.—Reconstructed upper end of the femur placed in the acetabulum after the removal of the head.

For older persons with the same degree of absorption of the neck and in whom the condition of the head is a little more doubtful, it is preferable to use some form of operation that demands removal of the head and placing the upper end of the remodelled femur in the acetabulum for skeletal support. This method is quicker, and therefore, better for the elderly patient who is subjected to the operation chiefly to relieve pain. Whitman's operation consists in lifting up the trochanter with its attached muscles, removing the head of the bone, reshaping the upper end of the femur and placing it in the acetabulum (Fig 3). The trochanter, as in Brackett's operation, is fastened to the femur at a lower level, and the leg is put up well in abduction in a plaster-of-Paris cast. Albee has recommended much the same procedure, except that, after removal of the head, he merely splits longitudinally downward through the trochanter well into the substance of the shaft of the femur, pries the trochanter and its attached muscles outward, by a sort of green-stick fracture at the base of the outer portion, and places in the acetabulum the inward, unfractured part of the split which he rounds off (Fig 4). The leg is put up into abduction and held there in a cast. The Lorenz bifurcation operation has also been recommended to furnish skeletal stability, but I have had no experience with it in cases of fracture of the hip.

Review of Cases—From January 1, 1919, to December 31, 1925, inclusive, 175 patients with fracture of the neck of the femur were examined in the

Mayo Clinic (Table I) Twenty-one of these patients had fresh fractures, so are not considered in this study, thirty-one came complaining of painful hips, but union seemed complete or nearly so and no treatment was recommended, and ten patients had pathologic fractures due to syphilis, osteomye-

TABLE I

*Cases of Fractures of Neck of Femur at Mayo Clinic
Between January 1, 1919 and December 31, 1925*

Type of fracture	Cases
United, with arthritis, pain, and so forth	31
Non-union, operation not advised (old age)	66
Non-union, pathologic	10
Recent	21
Non-union, operation advised but not performed	12
Non-union, operation performed	32
Mal-union	3
total	175

litis, or bone tumors, thus the number of patients that could legitimately be considered for surgical treatment was reduced to 113

However, most of the 113 were not considered suitable for surgical treatment, as only thirty-five (31 per cent) were operated on, thirty-two (28.3 per cent) for non-union of the neck of the femur, and three (2.7 per cent) for mal-union. Of the seventy-eight patients (69 per cent) who did not receive surgical treatment, there were twelve for whom operation was advised, but for various reasons was not carried out and sixty-six for whom operation was not advised because of old age, debility, slight disability, and so forth. This type of operation entails a long stay in hospital, and when the facts are fairly presented some patients are unwilling or unable to make the sacrifice

TABLE II

Results of Operation for Non-union of Neck of Femur

Operation	Not known	Not cured	Cured
Bone graft	2	5	16
Beef bone	0	0	3
Brackett	0	0	2
Whitman	0	0	4
Whole group	2	5	25
			83 per cent cured

Therefore but thirty-two patients received treatment for non-union of the neck of the femur. An analysis of the various types of operations performed and the results obtained is of interest. Taking the group as a whole, regardless of the means employed, a satisfactory result was attained in twenty-

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five instances That means that the patients were enabled to discard all supports such as crutches and canes, and again take part in their ordinary social and business activities Some, it is true, had a slight limp and a certain degree of stiffness, but all concerned were satisfied

A study of the results shows that there were no real failures except from the bone grafts (Table II) It must be remembered, however, that the aim in

TABLE III

Patients Operated on for Non-union of the Hip from January 1, 1919 to December 31, 1925

Age years	Sex	Duration of non-union, years	Operation	Cure	Failure	Not traced
53	F	0 5	Graft from fibula	0	+	0
45	F	0 75	Beef bone screw	+	0	0
41	M	0 5	Beef bone peg	+	0	0
			Graft from fibula			
44	M	0 5	Beef bone screw	+	0	0
30	F	0 75	Graft from fibula	+	0	0
35	F	0 5	Graft from fibula	+	0	0
53	M	0 5	Graft from fibula	+	0	0
37	M	1 0	Graft from fibula	+	0	0
49	F	1 0	Brackett	+	0	0
18	F	3 0	Brackett	+	0	0
28	F	3 5	Graft from fibula	0	0	+
58	M	1 5	Graft from fibula	+	0	0
52	F	0 5	Graft from fibula	0	+	0(death)
53	M	1 0	Graft from fibula	+	0	0
21	M	1 5	Graft from fibula	+	0	0
58	F	1 0	Whitman	+	0	0
55	M	2 0	Graft from fibula	0	+	0
35	M	1 5	Graft from fibula	+	0	0
46	F	1 5	Plastic Beef bone screw	+	0	0
40	M	2 0	Graft from fibula	+	0	0
47	M	0 5	Graft from fibula	0	+	0
40	M	0 5	Graft from fibula	0	+	0
50	F	0 5	Graft from fibula	+	0	0
52	M	3 0	Graft from fibula	+	0	0
39	F	2 5	Graft from fibula	+	0	0
32	M	1 0	Graft from fibula	+	0	0
54	F	1 5	Whitman	+	0	0
52	M	1 0	Graft from fibula	+	0	0
49	F	2 0	Graft from fibula	+	0	0
46	F	4 0	Whitman	+	0	0
68	F	3 0	Whitman	+	0	0
44	F	2 0	Graft from fibula	0	0	+

this type of operation is much higher, a more or less anatomic restoration being carried out, the technic is correspondingly difficult

The sexes were about evenly divided, there being seventeen females and fifteen males The ages ranged from eighteen to sixty-eight years, one girl was eighteen, two patients were between twenty and twenty-nine, six between thirty and thirty-nine, eleven between forty and forty-nine, eleven between fifty and fifty-five, and one woman was sixty-eight The duration of the non-union varied from four months to four years Fifteen patients had had non-union more than eighteen months, eight more than two years, five more than

three years. Of the last group the Whitman operation was used in two, in one the Brackett operation, and in two the bone-graft operation. In one of the latter the result is not known, but in the other case (a man aged fifty-two) the result was practically perfect. It was difficult to assign a definite cause for the non-union in each case, but, as is usual in this condition, the prime cause was lack of treatment, or, at best, treatment only for sprains, and so forth, at the time of the accident because no diagnosis was made. The next most important cause was the carrying out of poorly planned or poorly controlled treatment. There are now sufficient reports in the literature to establish the fact that the large majority of recent fractures of the hip will unite if logically treated by the abduction method.

There was one death, in the case of a healthy woman, aged fifty-two, following a well-executed bone-graft, as was shown at necropsy. This operation has naturally been classed as one of the failures, but, had it not been for the distressing accident of a cerebral embolus, union might reasonably have been expected. The embolus, a small one, evidently arose in the common iliac vein, travelled to the heart, and found its way through the patent foramen ovale to the brain. The patient became unconscious soon after awakening from the anæsthetic, and died two days later.

Calcium and phosphorus studies were made on some patients, but the findings were not conclusive.

SUMMARY AND CONCLUSIONS

The autogenous bone-graft, wherein the aim is to restore as nearly as possible the normal condition, is the operation of choice, and the fact that success was attained in 76 per cent of twenty-one cases indicates that it compares favorably with the bone-graft for non-union in other bones. In three cases the same happy result was accomplished by using the beef-bone screws, but these cases were more favorable in every way. The remodelling operations of Brackett and Whitman were carried out in six other cases with good results in all. In the latter group, however, there was more residual stiffness than in the former group, and function, although satisfactory, was by no means as good. The duration of the non-union is no criterion in selecting the type of operation. Some of the best results followed the anatomic type of operation, using the bone-graft, when non-union had existed for two and one-half and three years.

The autogenous bone-graft should be used in cases of non-union of the hip when the patient is in good health, when the disability is considerable, and when enough of the neck of the femur is left. One cannot state what the maximal age should be for this operation, but it is my opinion that if the patient is more than fifty-five, one of the other types of operation, such as that advocated by Brackett, Whitman or Albee, should be employed. Each

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY

Stated Meeting Held January 27, 1926

The President, DR WALTON MARTIN, in the Chair

SEPTIC ARTHRITIS OF KNEE

DR CHARLES E FARR presented a girl, six years old, who entered St Mary's Free Hospital for Children, May 12, 1925, and is still resident there. She had been run down and knocked over by an automobile immediately before admission, sustaining a compound, comminuted fracture of the right femur about the middle third, with a complete loss of skin over the mid-thigh to the lower third of the leg. A bridge of skin two inches wide passed across this gap, but was completely lifted from the underlying structures and was evidently sure to slough. The shock was so extreme that amputation was inadvisable, and on the other hand, the muscles, nerves, and vessels were normal and intact. After careful deliberation it was decided to try to save the extremity. A thorough debridement was carried out, a pin passed through the os calcis for traction, and Dakin's irrigation instituted. In addition various supportive measures for shock were carried out. The child rallied feebly, and a severe infection set in. The skin sloughed widely and general sepsis ensued of the streptococcus non-hæmolytic type. This was combated in the usual way with supportive measures and transfusions.

About the thirteenth day the opposite knee became involved in an acute septic arthritis. After observation for five days this knee was widely opened on either side by Doctor Freeman, and a large amount of pus containing the non-hæmolytic streptococcus evacuated. No drains were placed, only a small dressing was applied, and vigorous attempts were made to induce active motion. This was carried out by tickling the sole of the foot, causing the child to flex the knee to the point of pain. Then by gentle traction the leg was again extended. There was slow but steady progress in the use of the joint, and it healed in a comparatively few weeks. The general sepsis had subsided. Union eventually occurred in the fractured femur with considerable loss of bone and moderate bowing. A very large surface remained for skin grafting. This was carried out in stages and eventually was completely successful.

Flexion and extension of the infected joint are now normal. Weight-bearing causes no symptoms. There is a barely perceptible soft creaking, but no other remaining evidence of synovitis. This is the seventh consecutive case of septic arthritis of the knee in children which the reporter had treated in this manner. Of these six have given perfect results, and one only, in whom active motion could not be induced, resulted in a permanently stiff joint.

BOWEL INFLATION FOR INTUSSUSCEPTION

DOCTOR FARR presented a male infant, seven months of age, who entered St Mary's Free Hospital for Children, October 15, 1925. He was a breast-fed child in the most robust condition and with no past illness and no relevant family history.

CONTUSION OF THE ABDOMEN

Present illness began forty-eight hours before admission with a history typical of intussusception. He had colic, vomited repeatedly, had one normal stool which was followed by a small stool of mucus and blood. The child was in marked shock, and vomited at intervals. There was a little blood in the rectal mucus and a mass could be felt in the left lower quadrant.

The child was anesthetized with ether; the nozzle of a Davison syringe inserted in the rectum, and the colon inflated with air. This procedure was carried out on the operating table during the course of preparation for laparotomy. The mass in the left lower quadrant rose to the left upper, passed across the epigastrium to the right upper, and then to the right lower quadrant. Here it seemed to disappear and a fairly careful examination under the anæsthetic failed to reveal any further evidence of a mass. The abdomen was then opened with a split right rectus incision, and the only findings were very marked congestion and œdema of the lower ileum, the cæcum, and the ascending colon. The appendix was very hemorrhagic but was not removed. The ileum was considerably distended with gas but no further lesions were found and the abdomen was closed. The child was in considerable shock for the first twenty-four hours, then rallied well and left the hospital at the end of two weeks in excellent condition. The wound healed by primary union. The usual ileo-colitis yielded promptly to a proper diet.

DOCTOR FARR remarked that the reduction of the distal portion of an intussusception, especially of long standing, consumes more time than is warranted in these shocked little patients. One must either manipulate with the finger in the abdomen rather blindly, losing considerable time and increasing the shock already present, or must eviscerate and cause greatly increased shock. The procedure of air inflation is done during the giving of the anæsthetic. It requires but a moment, causes no shock, and at once relieves a large portion of the bowel from the pressure on its circulation. In this particular case the intussusception was entirely reduced, but it would be highly unwise to rely upon such a result as a rule. It at once shortens the operation by about one-half, and lessens the shock to a very marked degree. The use of air rather than water is recommended because air is completely elastic and can scarcely do any damage, and because it will instantly leave the bowel through the rectal tube on relaxation of the pressure on the syringe. This further aids in the performance of the laparotomy.

This or a somewhat similar procedure he had now used in three cases with excellent success, two complete reductions and one partial. The use of enemata for the reduction of intussusception is very old and would still be justifiable in circumstances prohibiting a laparotomy. It would hardly suffice in an intussusception of the small bowel. The use of a barium enema for diagnostic purposes as well as partial reduction of the intussusception has also been tried with success.

CONTUSION OF THE ABDOMEN

DOCTOR FARR presented three cases of contusion of the abdomen.

CASE I—A man forty-six years of age entered New York Hospital, service of Doctor Gibson, November 19, 1925. He had been struck in the left lower abdomen by the pole of a wagon four hours before admission. There was very severe pain immediately with profuse sweating. Twenty minutes later he vomited a half cup full of blood and had a profuse cold sweat. The pain by degrees gradually became localized in the left lower abdomen. When admitted pain was confined only to this spot and was

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produced only by movement. He was a robust man evidently in considerable pain. There were no respiratory signs nor symptoms. Examination was negative except for the left lower quadrant where there was extremely marked tenderness and rigidity. His pulse was 76, and his temperature 98-8/10, his respiration was 20, his blood-pressure was 130 over 80. One hour later it was 126 over 84. Two hours later 135 over 80, and again two hours later 128 over 66. His leucocyte count was 6500 on admission with 76 per cent polymorphonuclears. Four hours later it was 12,000 with 85 per cent polymorphonuclears. The following day it was 14,000 with 88 per cent polymorphonuclears. Urinalysis on admission showed a trace of albumin, a very faint trace of sugar, granular casts, leucocytes, epithelial cells, and urates. On the following two days urinalyses were practically negative. Two hours after admission his pulse had dropped to 72, his respiration to 18, his temperature had risen to 101-2/10. There was no vomiting and the history of bloody vomitus was not confirmed.

The man seemed to be rather severely injured. He was extremely tender and rigid in the left lower abdomen, his temperature and blood count rose, but his pulse, respiration, and blood-pressure did not go up correspondingly. The tenderness seemed more localized. It was determined to await events. During the next forty-eight hours there was a gradual subsidence of all symptoms, and on the fourth day he was allowed to go home. He was kept under observation by his family physician and made a perfect recovery. A moderate soreness in the left lower quadrant persisted for several days, evidently due to the condition of the abdominal wall, but at no time did any evidence of internal injury develop.

CASE II—*Traumatic Rupture of Spleen*—A man, thirty-four years of age, entered New York Hospital, November 27, 1925, having received a blow by a barrel which had fallen about thirty feet, striking his head and left shoulder, apparently a glancing blow. He was not completely unconscious but there was severe pain in his chest, back, and abdomen. The pain seemed to be increasing. There was no vomiting. His past history was negative except for a chronic productive cough. He thinks he had pneumonia, but never saw a physician. He was evidently quite ill but not apparently in immediate danger. He was poorly developed, slightly emaciated. He had a small cut beneath his left ear and another across the bridge of his nose. He had several discolored areas over his left shoulder and body. His respiratory movements were slightly restricted but otherwise normal. There was possibly diminished breathing at the left base. Coarse râles were heard over the whole of his chest, seemingly from his larynx or trachea. There was slight but definite tenderness and rigidity of the left abdomen.

On admission his temperature was 102-6/10, pulse 84, respiration 24. His blood-pressure at that time was not recorded. Within an hour it was taken and read 30 over 18. His pulse at this time was so rapid it was almost uncountable and had very little volume. His leucocyte count was 14,000 with 78 per cent polymorphonuclears. After the operation it rose at once to 28,000 with 92 per cent polymorphonuclears. His urine showed only a few leucocytes, otherwise it was negative.

He was operated upon immediately through a left rectus incision, with a right angle extension toward the spine. The abdomen was full of recent and older clotted blood. The spleen was torn extensively from the hilum and was bleeding very freely. It was removed. A small portion of the blood was aspirated. The wound was closed without drainage. During this time the patient was in a condition of extreme shock. An infusion of saline was given.

At the end of the operation his systolic blood-pressure was 83, and his pulse was barely perceptible. His condition seemed desperate and proctoclysis and bandaging of the three extremities were resorted to. The patient rallied fairly rapidly, but had a very sharp reaction reaching a temperature of 103.4/10 and a pulse of 136.

On the eighth day he gave the signs and symptoms of pulmonary embolism, coughed up bloody sputum, had pain and a temperature reaction. In the next few days he had eight or ten more pulmonary emboli. From the thirty-fifth post-operative day his temperature was normal, but he had a productive cough with blood-stained sputum. His skin reaction to old tuberculin was positive, but no tubercle bacilli could ever be found on repeated examinations.

CASE III—*Ruptured Jejunum*—A man, forty-one years of age, entered New York Hospital, December 17, 1925, in the service of Dr. Charles L. Gibson. Three hours before his admission he had fallen ten feet, landing on a beam on his abdomen. He was not unconscious, did not vomit, but complained of severe pain in the chest and abdomen, and of extreme tenderness. There was no bleeding from the mouth nor from the rectum. He immediately passed urine spontaneously and it contained no blood.

Although he gave a history of a perforated gastric ulcer four years before this accident and he had also had enteric fever and pneumonia, he was a very robust man, apparently in perfect health. On admission to the hospital his pulse was 80 and dropped to 72. His respiration was normal and remained so throughout. His temperature was normal. There were a few abrasions on the pubis and thighs and marked tenderness in the left and right lower chest in front and very marked rigidity of the entire abdomen with no special spot of tenderness. The patient appeared in excellent general condition with good strong pulse, good color and smiled when talked to, although he said he was in extreme pain. His blood-pressure on admission was 135 over 90. One hour later it was 120 over 70, and one-half hour later still 120 over 70. The leucocyte count was 12,000 with 76 per cent polymorphonuclears, and in an hour it had risen to 22,000 with 88 per cent polymorphonuclears. His urine was normal except for a few leucocytes and doubtful red cells. An X-ray picture of the abdomen revealed no free gas in the peritoneal cavity.

At the end of one and a half hours of observation his pulse had risen to 80, there was still marked rigidity and complaint of great pain in the abdomen without localization, an increased blood count, and a slight drop in blood-pressure. Although his excellent color and quality of pulse, no vomiting, no passage of blood, no free gas in the peritoneal cavity, no localized spot of tenderness, would have warranted a waiting policy, the safer course seemed to be an exploration, with the tentative diagnosis of rupture of a viscus. Under ether narcosis the old scar for gastric perforation was reopened. A few omental adhesions were found, the abdomen proved to be filled with recent and old blood and a very moderate amount of fluid feces. There was absolutely no gas as determined by the Gibson Water Test on entering the peritoneal cavity. The first loop of bowel presented was the upper ileum or lower jejunum. It was torn nearly completely across transversely. It was no longer bleeding. There was very slight fecal leakage. The entire bowel for a considerable distance had nearly completely collapsed. This tear was at once repaired with fine chromic catgut. A search was then carried out from the ileocecal valve to the end of the duodenum. A second tear in the bowel exactly similar to the first was found in the jejunum two or three feet above the first lesion. This was repaired with chromic catgut. The lacteals were

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markedly engorged but there seemed almost no fluid residue in the bowel and no gas. Very careful examination of the entire abdomen revealed no evidence of further injury. The pelvis was filled with fluid blood and a little fecal material. This was found also scattered throughout the abdomen and was removed with an aspirator. The stomach was apparently intact, showing no evidence whatever of the old perforation, except a few fine adhesions around the duodenum and the spleen. The abdomen was closed in layers without drainage. The patient left the operating table in excellent condition and with a pulse of 92.

The wound healed by primary union although the patient developed a mild post-operative pneumonia.

GASTRO-MESENTERIC ILEUS

DR. CHARLES L. GIBSON presented a man, age twenty-seven years, who was admitted to the New York Hospital, June 17, 1925. He gave a history of epigastric pain and distress over a period of two years, and vomiting and other signs of pyloric obstruction for a period of two months. Fluoroscopic examination showed a dilated stomach and duodenum with twenty-four-hour retention, and obstruction apparently at the apex of the duodenum. At operation a band was found which constricted third portion of the duodenum, causing a marked dilatation. Since the band contained the superior mesenteric artery, it was impossible to divide it, so a posterior no-loop gastro-enterostomy was done.

Except for some vomiting on the first post-operative day, convalescence was uneventful. He was discharged on the thirteenth post-operative day in good condition, the wound healed. Three months later he had been eating everything and had gained about twenty pounds.

Six months later. Excellent condition. Has held his twenty-pound gain in weight.

CASE II.—DOCTOR GIBSON presented also a man, age twenty years, who was admitted November 15, 1924, with a history suggestive of appendicitis. Appendectomy was performed, but showed little if any pathological condition.

One month later he was readmitted on account of intense and continuous pain in lower abdomen, increasing in severity. Vomits also quite frequently, usually a half to an hour after meals.

A fluoroscopic examination resulted in a diagnosis of post-pyloric ulcer.

At operation, a large distended stomach and duodenum, as far as third portion, found. No apparent ulcer could be made out. The duodenum was sharply obstructed at the site of the superior mesenteric artery. A posterior gastro-enterostomy was done.

He made a good convalescence. On discharge, condition greatly improved. Pain and epigastric distress entirely relieved.

Three months later. Stomach in fine condition. Can now eat all kinds of food.

A year later. Excellent condition. Eats all kinds of food with no discomfort.

DOCTOR GIBSON remarked that these patients were operated on and are reported with a full appreciation that the operation of gastro-enterostomy in such conditions is considered by many, perhaps most, authorities as not the most suitable operation.

Duodenostomy and duodenojejunostomy have been the operations which have been generally recommended to perform. There is, however, a rather suspicious lack of convincing end results quoted to back up this practice. In addition to these operations, other procedures have been employed, some of them apparently quite foolish, as for instance resection of the ileocaecal coil.

If one looks upon the alimentary tract simply as a diagram the gastro-enterostomy is open to objection, but one must remember the changes that come in any stenosed tube after deviation of its habitual contents, for instance, relaxation of the oesophagus after gastrostomy, and the permeability of a tight urethral stricture after external urethrotomy. Moreover, the obstruction in this case is by compression and not an organic stenosis, and it does not require much space to allow for passage of normal fluid contents of the duodenum, that is the pancreatic juice and bile.

His objection to duodenostomy and duodenojejunostomy was that the late results in that such operations seem to have more possibilities of subsequent trouble from distortion, shrinkage and adhesions. They are also harder to perform.

It is most important to consider the possibility of duodenal stenosis by compression of the superior mesenteric artery in doing certain operations which do not provide indirect drainage of the stomach such as pyloroplasty, gastrioplasty and the Billroth No. 1 type of resection. Halberstam has reported three cases of Billroth No. 1 requiring re-operation on account of this condition, Finney two cases after his pyloroplasty.

He had recently had a third case, an hour-glass stomach, in which this complication, compression of the duodenum existed. The case, however, is of too recent a date to report, although up to this time she has been very well following a gastro-enterostomy in the main proximal pouch.

DR JOHN DOUGLAS said that it was difficult to see why gastro-enterostomy relieved the obstruction. As a contribution to the subject he showed some radiographs of a case recently operated on at St. Luke's Hospital. This was a man who came to the hospital the latter part of last May with a diagnosis of duodenal ulcer. He was operated on on June 1 and an indurated ulcer was found. Gastro-enterostomy was done with no soiling. For six days his recovery progressed uneventfully, there was no vomiting and no rise of temperature. On the seventh day he started to vomit and this continued. The stomach was washed out but with little result. On the 12th day of June a plain X-ray plate was taken which gave no information. June 17 a series of radiographs were taken after ingestion of barium. The stomach was shown to be distended with a very much distended duodenum to where the gastro-mesenteric ileus occurs. The radiographs show apparently nothing going through the stoma. It seemed difficult to know what to do but apparently the gastro-enterostomy was not working. So the wound was opened under local anaesthesia and a large number of adhesions found but the gastro-enterostomy seemed to be all right, it was possible to put two fingers

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through the opening. As the stomach had been thoroughly lavaged before operation, there was nothing in the stomach or duodenum. The adhesions seemed to have been the cause of the obstruction, and it was hoped that these having been separated, the ileus would be relieved, but a duodenal tube was passed from the mouth and brought into the distal loop of the jejunum with the idea of feeding him through that. There was no vomiting for a few days, but on aspiration some bile was obtained on the third day after the second operation and he started to vomit and burst part of the wound open, and something, either stomach or intestinal wall, was projected. He was opened up again and more adhesions found and the viscus that was projecting was found to be part of the stomach wall. The jejunum was distended and there was local peritonitis around that area. At this time a jejunostomy was done. He was in bad condition, with a blood urea of 65, and he died the following day. The obstruction was due probably, to contamination, perhaps from some leakage from the original ulcer, which caused dense adhesions in this region. In such cases of so-called vicious circle, if found early by X-ray, it might be possible by duodenojejunostomy to relieve the condition, when the obstruction is at the duodenojejunal angle, as is sometimes the case, as the ordinary jejunostomy would be of no avail.

DR. WALLER M. BRICKNER related the history of a young married woman with gastroparesis who had been vomiting for about eight years and had become much emaciated. Fluoroscopy showed dilatation of, and retrograde peristalsis, in the duodenum. No relief had been obtained with medical treatment. Operation revealed obstruction at the duodenojejunal angle and very evident dilatation of the duodenum. In addition there were some adhesions between the duodenum and the gall-bladder, but the latter was otherwise apparently normal. Duodenojejunostomy was easily performed and gave prompt relief. The patient gained steadily in weight and ceased vomiting. Seen recently, two years after the operation, she is in excellent health and has no vomiting or other symptoms.

DR. ALFRED S. TAYLOR said it was not a logical procedure to do a gastroenterostomy for obstruction at the end of the duodenum. With regard to the statement that there is no authentic case of cure from duodenojejunostomy, Kellogg has reported several, in fact, a series of 40 to 150, in a large number of which the results have been very good. The speaker said he had had cases where there was chronic duodenal obstruction in which duodenojejunostomy did very well. It seemed to him that one ought to be clear as to which method to choose, but personally he preferred duodenojejunostomy to gastro-enterostomy.

DR. HERMANN FISCHER said that he had occasion to operate in two cases for a duodenal obstruction at the duodenojejunal angle. The first patient was a woman which the speaker had presented to the Society several years ago. She had been in the medical ward for observation on account of continuous occult hemorrhages resulting in a severe secondary anemia. X-ray examina-

CYST OF PANCREAS

tion of gastro-intestinal tract did not reveal the site of the lesion. Finally an exploratory laparotomy was done for a suspected carcinoma of the colon. The lesion was found at the duodeno-jejunal angle. It was a tumor of a probable inflammatory nature in consequence of a jejunal ulcer. A duodeno-jejunostomy was done with good immediate effect. The occult hemorrhages stopped for several months. The subsequent course of the disease, however, was unfavorable. The lesion was probably a carcinoma, for she died very cachectic about one year after the operation.

The second patient suffered from a carcinoma of the pancreas which had invaded the retroperitoneal tissue and caused an obstruction at the duodeno-jejunal angle. A duodeno-jejunostomy was done. The patient who was in very poor condition did not rally from the operation and died two days after the operation. In obstruction of the duodenum at the duodeno-jejunal junction, duodeno-jejunostomy should be done instead of a gastro-enterostomy.

DOCTOR GIBSON, in closing the discussion said that in these cases the obstruction could not be described as at the duodeno-jejunal angle. There exists a difference of opinion in regard to the proper operation to be performed, but he has not found the results of duodeno-jejunostomy to be so brilliant as they are described. He realized perfectly that gastro-enterostomy was not the logical operation in these cases, but the fact remains that they have been relieved of their symptoms after suffering very acutely.

CYST OF PANCREAS

DR JOHN M. HANFORD presented a man, aged thirty years, who was admitted to the Presbyterian Hospital March 7, 1924, with the following history partly obtained by a letter from a surgeon who had previously operated upon him.

December 21, 1923, he was injured in an automobile accident and was taken to a nearby hospital. He was unconscious for the first twenty-four hours. He then began to vomit. Vomiting continued, together with pain in the upper abdomen, and then subsided but recurred. There were evidences of fluid in the abdomen. He was operated upon about five days after the injury. The findings of this operation are reported to have been: Free blood in the peritoneal cavity, an adhesion of the transverse colon to the pylorus and bleeding from the pyloric vein upon separating this adhesion. This is thought to have been the source of the bleeding. A small tear in the spleen was suspected but on account of his poor condition it was not explored.

During convalescence from this first operation he again started vomiting and it was thought that he had distention of the stomach without general abdominal distention.

On entering the Presbyterian Hospital he said that he had had vague discomfort in the left upper quadrant and slight prominence of the abdomen since leaving the former hospital. A week before admission to the Presbyterian Hospital he had had severe pains in the left upper quadrant during and following the taking of food. Enlargement of his abdomen began to increase rapidly, and on the day of admission he vomited a little green fluid. He complained of numbness in the right upper limb since the injury.

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He was a poorly nourished, chronically ill appearing young man. There was marked bulging and prominence of the abdomen rather more to the left than the right and more in the upper than in the lower abdomen. There was a recent right rectus scar with three small granulating areas in it. There were no visible pulsations. Palpation revealed abdomen generally tense. A fluid wave was present. There was tympany in the right flank and in the right lower quadrant and dullness in the left flank and left upper quadrant with little change on change of position. The splenic dullness appeared increased, but neither spleen nor liver were felt. Succussion sound was obtained in the anterior upper part of the abdomen.

The temperature, pulse and respiration were normal. The blood count, urine and blood Wassermann were all normal. Plain X-rays of the abdomen in the supine and lateral positions showed "A shadow which might be due to a cyst or tumor in the upper abdomen."

The gastro-intestinal X-ray examination showed "The left diaphragm slightly elevated. A gas bubble not in contact with the diaphragm as it usually is. The stomach flattened against the anterior abdominal wall." The roentgenologist indicated that there might be something pushing the stomach forward from behind.

Operation March 15 1921—On opening the peritoneal cavity the stomach presented and appeared normal except that it was low in position and rather flattened antero-posteriorly. There was no free fluid in the general peritoneal cavity. Exploration of the general cavity was difficult because of the extreme tenseness of the fluid in the lesser sac. On exploring further it was found that the lesser omentum was tense and bulging forward and fluctuated. An aspirating needle was inserted about 2 or 3 cm. above the lesser curvature of the stomach and watery turbid fluid was withdrawn. Through the needle puncture more fluid spurted out, so that a larger opening was made and a sucker inserted. There must have been about 5 liters of this fluid completely distending the whole lesser sac. The lining of the sac on thorough investigation appeared normal except for three things: (1) Obliteration of the foramen of Winslow. (2) A varicosity on the anterior surface of the left renal vein in front of the vertebra. (3) A 4 cm. tear in the peritoneal surface just behind the middle of the lesser curvature of the stomach.

On tracing with a probe into this tear no opening in the stomach wall could be detected. There was no evidence here of inflammation. It is possible that this tear may have overlaid the varicosity and that at the time of the injury both lesions were produced. The fluid was more like that of a transudate than of an inflammatory exudate. Yet it is hard to understand the obliteration of the foramen of Winslow. Adhesions between the great omentum, the right border of the lesser omentum and the anterior abdominal wall prevented exploration of the gall-bladder and the whole upper right side of the abdomen. The pancreas felt soft and normal but was displaced downward apparently by the tremendous distention of the lesser sac. The fluid from the lesser sac was all aspirated. Exploration further revealed the boundaries of the lesser sac to be those of a sacculated collection of fluid. The wound was closed, leaving a Penrose tube of a soft rubber dam drain in the lesser sac through the opening in the lesser omentum.

The pathologist reported that the bit of tissue removed from the lining of this sacculated cavity showed dense connective tissue with swollen collagen fibrils, and lining membrane apparently composed of atrophic connective-tissue cells and very little inflammatory reaction.

CYST OF PANCREAS

An examination of the fluid obtained revealed a cell count of 163 per c c with a differential count of 60 per cent polymorphonuclears and 40 per cent lymphocytes. It contained minute amounts of amylase, protease, sodium chloride and sugar.

After the first two days very little leakage occurred from the wound. Ten days after operation there was a definite recurrence of the swelling in the left upper abdomen and he complained of a sense of fullness after eating, some pain in the left upper abdomen and belching of gas with relief. The same physical signs were again obtained and repeated examination of the gastro-intestinal tract revealed much the same finding as before.

March 20, 1924, two weeks after the first operation in the Presbyterian Hospital he was again operated upon going through the upper part of the recent wound.

Much the same findings appeared. The omentum was opened and three litres of turbid straw-colored fluid was aspirated. This fluid was more turbid than on the preceding operation. This time, instead of using soft rubber tubing of the rubber dam type, ordinary rubber tubing was used, one tube passed behind the body of the stomach downward and the other behind fundus toward the left.

Culture of this fluid showed staphylococcus aureus and it contained amylase, protease and lipase in very small amounts. It did suggest pancreatic secretion.

Following this second drainage of the lesser sac the man felt better. He still had some pain in the left upper quadrant and digestive symptoms after eating but at no time since then has swelling of the upper abdomen appeared. Leakage of clear pale watery fluid occasionally containing lipase, continued in varying amounts for several months.

May 6, 1924, he was discharged from the hospital apparently improved but still draining fluid.

Closed permanently four and a half months after second operation.

CASE II.—The patient, an adult woman, came to the Presbyterian Hospital August 14, 1925. Six years previously she had been ill for four weeks with severe pain in the lower abdomen and rectum. She states that then something "broke" in her rectum quite suddenly and then she evacuated a large amount of pus with almost immediate relief of pain. For many years she had been constipated.

Her recent illness dated from June, 1925, when she began to have diarrhoea, followed by severe cramps in the abdomen, distention, and high fever. She was then acutely ill and these symptoms continued for about two weeks, after which she tended to improve.

A few days before admission she had a relapse of the same symptoms of fever, abdominal pain, vomiting, distention and prostration. She also had pain in her back and left upper quadrant. There had been absolutely no respiratory infection but just prior to admission she developed a pain in the right lower lateral chest, increased on deep breathing.

On admission the essential physical signs were as follows. There were signs of fluid at the lower posterior chest, but no change in position in the liver outline. Slight distention and definite resistance of the whole abdomen. Rigidity of the upper right quadrant. Pelvic examination normal. She was acutely ill, pale, sick, with rapid pulse of poor quality and high fever. Leucocyte count, 16,800. Polymorphonuclears, 87 per cent. Slight secondary anaemia. Urine normal. Examination of stool revealed no evidence of blood, ova or parasites. Pus was not reported but grossly stools appeared to contain much mucus with pus.

Aspiration of the right lower pleural cavity behind yielded a little fluid containing polymorphonuclears, which suggested a nearby pyogenic infection. Her blood culture proved sterile.

Fluoroscopy and X-ray examination of the chest indicated a small amount of fluid in the right costophrenic angle but fluoroscopy suggested nothing to indicate a subdiaphragmatic abscess.

Operation Under Gas and Ether, August 16, 1925—On opening the peritoneal cavity, through the right rectus incision, there was a small amount of slightly turbid free fluid. The great omentum was found on the superior aspect of the liver, over the right lobe, where it was adherent by fine fibrinous adhesions in the shape of a great flat disc, about 15 cm in diameter. This disc was somewhat bluish, very indurated and apparently the site of acute inflammation. The pedicle of the disc was normal omentum. This disc of omentum was easily separated from the upper surface of the liver and under surface of the diaphragm, leaving slightly bleeding surfaces. The liver was otherwise made out normal. There was no suggestion of an abscess nor of multiple abscesses. It was but slightly if at all enlarged. There was no subphrenic accumulation. It was only after the displacement of this disc of omentum that the subhepatic space could be explored. The gall-bladder was nowhere to be found, but in its space lay a definite cystic mass which was at first thought to be an abscess. It lay rather deep in the posterior wall of the peritoneal cavity to the right of the duodenum and beneath the posterior part of the right lobe of the liver. After exploring this fluctuating surface it was aspirated, when perfectly clear fluid appeared in the syringe. It resembled spinal fluid. Having discovered that this was no abscess, it was left alone, and the exploration continued. Passing the hand down the abdomen a mass was found just below the umbilicus beneath the anterior abdominal wall. In exploring this mass, the finger entered a pocket and thick, foul-smelling, yellowish-brown pus appeared upon the examining glove. This evidently meant a localized peritoneal abscess, just below the umbilicus. Passing the hand down the right lumbar gutter and toward the pelvis, nothing else could be found. There was apparently no evidence of appendicitis because the abscess seemed to have no connection with the right lower quadrant. It was thought possible that this was due to a Meckel's diverticulum or was an infected cyst of the urachus.

The peritoneal abscess was drained through a lower right rectus incision and a jejunostomy was done through a small wound in the left upper abdomen. The jejunostomy appeared indicated because of the evidence of an acute diffuse peritonitis, with distention and vomiting.

She was acutely ill for several days after operation, but except for the signs of a mild post-operative pneumonia, she was slowly but steadily improved.

Culture of the cyst fluid was sterile. No pancreatic ferments were present. Culture of the pus from the peritoneal abscess showed hæmolytic staphylococcus aureus.

For a long time she continued to run a temperature of 99 to 101. She left the hospital September 15, 1925, and for two or three months subsequently continued to have slight fever and elevation of pulse. Her strength has increased and now she has occasional temperature of 99 with a slightly elevated pulse.

She still has the signs of what is thought to be thickened pleura at the right base. Her digestive tract is functioning satisfactorily except for slight tendency to constipation. There is a ventral hernia.

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HIGH ENTEROSTOMY FOR ILEUS AFTER APPENDICITIS

This woman is now thought to have had a pseudocyst of the pancreas associated with a preceding acute atypical pancreatitis. She is to be frequently observed over a long period.

ADENOCARCINOMA OF SIGMOID COLON

DR SEWARD ERDMAN presented a man, who was admitted to the New York Hospital, October 14, 1916, aged sixty-six years. The history ran back for half a year, during which time he had had occasional passage of blood and mucus by rectum. Occasional faint attacks and recently two attacks of obstipation with vomiting, with loss of weight and strength. Examination showed a nodular sloughing tumor hanging down in the mid-rectum, apparently invaginated from above.

October 30, 1916, an exploratory operation was performed which revealed the lower sigmoid invaginated into the upper rectum. This was easily reduced and a tumor was palpated in the sigmoid, measuring about 4 inches in diameter. The entire loop was drawn out of a left inguinal incision and the wounds closed about it. The Mikulicz method was followed. On the fourth day the loop was removed with the cautery. Later clamps were applied to the spur, and on December 6 the artificial anus was closed by Lembert sutures of the gut and simple closure of the skin under local anaesthesia. No attempt was then made to prevent a hernia. The wound rapidly closed, but a slight hernial protrusion has always remained.

The patient gained weight and has remained perfectly well for these nine years.

DR CHARLES L. GIBSON remarked that he had a patient living thirteen years after a three-stage resection. At the time of operation 20 inches of gut were taken out and in the cut end of the meso there were cell nests found. The wound was kept open for four months and the cautery was used on the edges, which probably accounts for the patient being alive to-day. In another case large nodes were found which were carcinomatous. That man is alive and working seven years since the nodes were taken out.

HIGH ENTEROSTOMY FOR ILEUS AFTER APPENDICITIS

DR SEWARD ERDMAN presented a woman, aged thirty-four, who was admitted to the New York Hospital, June 8, 1924.

Two and one-half days before admission, she had been ill with general abdominal pain, localizing in the suprapubic region, with fever (101) and persistent vomiting.

On admission both lower recti were rigid, and a pelvic mass was palpable.

First operation, June 8, an immediate laparotomy was performed through a right paramedian incision. There was free turbid fluid. A mass filled the pelvis, consisting of thick creamy pus with foul odor, forming an abscess about a sloughed appendix, which was bound to the back of the uterus. Appendix removed and wound lightly closed about two drains to the cul-de-sac. Culture showed bac. coli communis.

The post-operative course was very stormy, with high temperature, much distention and recurrent vomiting, and much purulent drainage.

Second operation, on the ninth post-operative day, after several days of obstipation, distention and continuous vomiting, a jejunostomy was performed under local anaesthesia. Drainage averaged over 600 c.c. daily for five days, with relief of distention and vomiting. The tube was removed after five

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days and the wound healed without any gross leakage. Some improvement was noted, but the temperature continued.

Third operation, on the twenty-first post-operative day (June 29), a posterior colpotomy was performed to relieve a low pelvic collection, but this did not drain well, and by rectum the abscess could be felt pointing into the lumen.

Fourth operation, on the twenty-fourth day, the pelvic abscess was drained through the rectum and seemed to clear up the pelvic condition. However, the temperature continued and pain was complained of in the left hypochondrium. An X-ray on the twenty-eighth day showed a high left diaphragm, but aspiration with needle on this date failed to reveal the sub-diaphragmatic abscess.

Fifth operation, on the thirty-third day, a local abscess in the right iliac fossa was incised and drained.

Sixth operation, on the fifty-seventh day, after resection of a portion of the left tenth rib, a left subphrenic abscess of four ounces of pus was drained. Thereafter the general condition slowly improved, but purulent drainage persisted for a long time. The patient went home August 17, the seventy-eighth day. After one week, an abscess formed in the right flank lateral to the cæcum, and she was readmitted to the New York Hospital.

Seventh operation, on the eighty-eighth day (August 26), an abscess was incised and drained in the right lumbar gutter, and the patient was sent home September 12 with wounds granulating and suppuration over. Marked improvement and gain of weight set in and for six weeks the patient seemed well. Suddenly she developed acute intestinal obstruction and was admitted for the third time to the hospital.

Eighth operation (October 1) one hundred and twenty-two days after her first operation. The release of a kinked loop of ileum attached deep in the pelvis, relieved the obstruction and the patient went home October 16. Wounds healed.

May 30, 1925, she was admitted to the hospital for the fourth time. Eighteen hours before admission another attack of acute obstruction had developed.

Ninth operation, on the three hundred and fifty-seventh day, revealed an acute intestinal obstruction due to the catching of a loop of low ileum over a "shoe-string" adhesion band in the right lower quadrant.

At the last operation an opportunity was afforded to review the jejunostomy site from within. No adhesion was found to the parietal peritoneum, and only a small stellate cicatrix on the wall of the bowel at this point.

ANOMALOUS TUMOR OF THE CERVICAL LYMPH-NODES

DR SEWARD ERDMAN presented a man, aged thirty-seven years, whom he saw first in April, 1924. He had a swelling of the lymph-nodes in the left side of his neck, which had been gradually increasing since he first noticed it, about one and one-half years before. For the past four months increase in size had been more rapid. He had had a mastoid operation in childhood. Occasionally he suffers from hoarseness. There were no other symptoms and he would have left the condition alone, except that he had recently been rejected for life-insurance. No loss of weight nor strength.

On the left side of the neck, about the level of the thyroid, there was a swelling without any inflammatory signs over it.

Palpation revealed a mass beneath the sterno-mastoid, slightly irregular in outline and measuring about 5 cm. in diameter, also several almond-shaped nodes could be felt extending down into the subclavian region.

August 14, 1924, at the New York Hospital, the enlarged lymph-nodes were excised together with the gland-bearing fascia, from the level of the hyoid down to the clavicle

There was no peritonsillitis and the discrete nodes were removed quite easily. The gross appearance was that of a chain of about eight lymph-nodes, several of which presented cystic bluish areas, and one seemed to be simply a thin-walled cyst.

Pathological Report—Specimen consists of a mass, slightly lobulated, 5 x 4 x 2 cm (This being the upper and largest tumor.) Cut section has yellowish-white appearance, with some opaque areas and many cystic areas. The cystic areas measure from 1 mm to 1 cm in diameter and contain clear jelly-like (colloid) material.

Also a group of six other masses, varying from 1 to 3 cm in diameter. On section they have an appearance similar to that described in the largest mass.

Also a thin-walled cyst, 2 cm in diameter and filled with translucent jelly-like material of dark brown color.

Microscopic section shows the lymph-nodes to be almost entirely replaced by a tumor growth consisting of cystic spaces filled with colloid. The cysts are almost entirely filled by branching papillary projections of a fibrous stroma covered by a layer of polygonal cells which resemble epithelium. A similar epithelial-like layer of cells lines the cysts.

In some parts the epithelial cells grow in irregular sheets. Structures resembling epithelial pearls are found in some parts. In the stroma are structures filled with colloid-like material, which "resemble thyroid acini" (Fig 1).

Since operation, over one year and five months ago, the man has been feeling perfectly well. No loss of weight or strength. An X-ray of the chest taken January, 1926, "shows nothing that would indicate glandular enlargement or pulmonary pathology" (Belden). Examination of his neck



FIG 1—High power Showing (A) branching papillary growths (B) An epithelial pearl (C) Colloid acinus resembling thyroid tissue

does not show any gland enlargement. In left axilla a small node is palpable but probably is not significant.

Various pathologists have seen the sections and have ventured several different diagnoses.

(a) "Papillary endothelioma of lymph-nodes" was one of the first diagnoses, but the same pathologist has very recently revised this diagnosis, and now considers it—

(b) "A metastatic papillary adeno-carcinoma of the thyroid", or

(c) "An adeno-carcinoma of aberrant island of thyroid tissue". Another pathologist suggests metastases of normal or hyperplastic thyroid. Another suggests "cell rests" in the lower bronchial clefts.

In this case the most noteworthy feature was the entire replacement of the lymph-nodes by the peculiar tumor, also the unexpected presence of epithelial pearls.

Clinically the case does not appear to be malignant and the reporter inclined to the theory that it represents a peculiar tumor of developmental origin, rather than an adeno-carcinoma.

DR EDWARD W. PIERSON said that he had a case similar to this which was pronounced an aberrant thyroid. Doctor MacNeil so pronounced it and made a note that it was potentially malignant. The patient had X-ray treatments and has had no trouble since, although that was nine years ago.

FRACTURE OF ACETABULUM

DR CONSTANTINE J. MACGUIRE, JR. presented a man fifty-two years of age, who was admitted to the First Surgical Division, Bellevue Hospital, October 24, 1925, suffering from a fracture of the left acetabulum with inward dislocation of the fragments and of the head of the femur as the result of a fall directly on the side of the hip. The left thigh was held in flexion, slight abduction and external rotation.

Under anæsthesia reduction could be effected but could not be maintained as the shattered acetabular fragments remained in inward displacement and consequently the femoral head would fall back into the defect into the pelvis.

Further attempts were refused by the patient for three weeks when he finally consented to the introduction of a Steinman pin horizontally through the great trochanter. This was easily done and traction of twenty pounds applied from above with patient turned on his right side.

This kept the head of the femur out of the pelvis but rectal examination showed that the acetabular fragments were still displaced and could not be bridged by digital pressure.

Traction was maintained for two weeks and then a plaster hip spica with the thigh abducted was applied. The Steinman pin was kept in place under traction until the plaster hardened. The plaster spica was kept on for four weeks and followed by massage and motion. At present, three months after injury, he has one centimetre shortening, slight limitation of external rotation and abduction and an almost imperceptible limp.

This case was shown as exhibiting a new use for the Steinman pin, namely for direct traction in the axis of the neck of the femur. It might be an aid in realigning the fragments in fracture of the neck of the femur before immobilization in the Whitman position where the Whitman procedure has failed (if ever) of satisfactory reduction.

ACUTE KNEE-JOINT INJURIES

FRACTURE OF BOTH PATELLÆ

DOCTOR MACGUIRE presented a woman, who on March 15, 1925, being then thirty-four years of age, was admitted to the First Division, Bellevue Hospital, with a transverse fracture of the left patella the result of direct violence, namely a fall on the knee with the leg in flexion

The following day she gave birth to a full-term child. Two days later under local anæsthesia the usual operation was performed of suture of the extensive lateral tears in the capsule with chromic catgut. This closely approximated the widely separated fragments. Ten per cent novocaine gave complete freedom from pain.

Motion was started in ten days and complete function was obtained in six weeks.

One year later she fractured the opposite patella, this time by indirect violence in an attempt by sudden extension to save herself from falling. A similar operation again under local anæsthesia was followed by complete recovery.

X-ray pictures taken six months later showed bony union in the second patella fracture, but fibrous union in the first.

This case was shown to illustrate the possibility of perfect function irrespective of bony union, as the coincidence of fractures from both direct violence and indirect violence in the same individual. He also called attention to the satisfactory use of local anæsthesia by simple infiltration when indicated as in this case by a complicating frequency.

ACUTE SUPPURATIVE ARTHRITIS

DOCTOR MACGUIRE presented a boy, who November 10, 1922, at that time, eleven years of age, was admitted to the First Surgical Division of St Vincent's Hospital, suffering from an infected laceration of the right knee associated with elevation of temperature and rapid pulse. This laceration had been treated outside for a week previous to admission.

November 13, irregular rises of temperature to 103 degrees, pulse of 130 and septic appearance led to an aspiration of the knee-joint, which revealed purulent fluid which showed staphylococci and Gram-positive and Gram-negative bacilli.

Lateral incisions in the usual manner to the limit of the synovial cavity were made and active and passive motion started immediately post-operative. The day after operation the patient was forced to get up and walk about the ward. The temperature immediately fell to 99 degrees and never again reached 100. Complete extension during walking could not be accomplished by the patient for about six weeks, but by the second of January, 1923, full flexion and extension had been restored with only a slight limp. The inner opening had closed but the outer opening was still discharging a large amount of cloudy fluid, particularly evident during motion.

The boy was discharged as cured February 3, with both wounds closed and full function of joint.

ACUTE KNEE-JOINT INJURIES

DR CONSTANTINE J MACGUIRE, JR, read a paper with the above title, for which see page 651.

DR SEYMOUR M MILLIKEN said that the experience of Doctor MacGuire corresponded with his own and he agreed with all he said. The knee-joint does resist infection very well. He had a case with fracture of the thigh

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and the patella and when the knee-joint was opened there was flocculent serum in patella buisa which caused superficial infection of the knee-joint region without involvement of the joint cavity. The knee-joint has not been involved in the infection. In the dressing of these patella cases he had followed the practice of putting them up in cotton wool and firm bandage, allowing active motion when the patient was ready to move it, and no passive motion at all. Active motion is permitted as the patient turns in bed. No splint used.

DR HERMANN FISCHLER said that war experience gave a wrong picture of many of these infections and enthusiasm was carried too far. Technical procedures in infections of the knee-joint have been exhausted and the outcome depends on the virulence of the bacteria and the forces the patient has to ward these off.

DOCTOR FISCHLER said he had not heard Doctor MacGuire speak of the importance of the phlegmon of the capsule and peri-articular abscesses. If there is infection of the synovial membrane without capsular phlegmon the problem is simpler and excellent results can be obtained by aspirating and washing out the knee-joint. For this purpose he prefers a 1:1000 solution of Rivanol. If there is capsular phlegmon present the joint should be opened widely. In spite of thorough drainage of the knee, these cases will often do badly, necessitating opening of the joint after Mayo or an amputation should be done.

The speaker has employed the Mayo operation in several desperate cases with gratifying results. The patients, of course, had a stiff knee, but the leg was preserved.

DR WALTER M. BRICKNER said that for several years he had been treating traumatic synovitis, especially of the knee-joint by aspiration and mobilization (preferably without immediate weight-bearing). It is a simple procedure which can be safely performed in the office of the dispensary and which reduces the period of disability from two months or more to two weeks or less. In his experience and in that of some other observers, the fluid aspirated in an early stage of traumatic synovitis is blood or bloody, and only after many days does it become what it is so often called, "water on the knee." One should therefore regard a traumatic synovitis as being in fact a hæmarthrosis. Accordingly there must be in all these cases some tear of the joint capsule and an injury of overlying bone, cartilage or ligament. If roentgenograms are made from various angles and with great attention to secure detail there will not rarely be found, upon close scrutiny, a crack in one of the bones entering into the joint. Injury to ligament or cartilage can not be thus diagnosed roentgenographically. In a case of recurrent and persistent effusion in the knee-joint, following two direct traumata, roentgenograms showed fissure detachment of a small oval fragment of the articular surface of the lateral femoral condyle—an early stage of osteochondritis dessicans. The fragment remained in place but showed no tendency to unite under prolonged observation. Accordingly Doctor Brickner performed a free arthrotomy, which exposed not only the small osteo-chondral fragment seen in the

rontgenogram, but also a much larger and looser fragment of articular cartilage from the same condyle, which had not shown because no bone was attached to it. Probably more often than is recognized there is such a cartilage injury, especially in cases of persistent or recurrent synovitis, demonstrable only by arthrotomy or sometimes, by pneumo-rontgenography.

DOCTOR BRICKNER agreed with Doctor MacGuire that, in spite of textbook teachings, it is not necessary to remove the entire internal meniscus when it is the seat of a tear or dislocation, the posterior portion is often firmly attached in place, and its retention appears to do no harm.

The Willems' treatment of pyarthrosis was heralded during the war as a great advance. In all the cases under Doctor Brickner's observation in the A. E. F. it was impossible to carry out the treatment because the knee infection was associated with a compound fracture of the leg or thigh. In civilian practice, too, even in cases without fracture, it is very often impossible to make the patient walk because of the severe pain and spasm. It is, moreover, doubtful that weight-bearing is desirable during active suppuration in the knee-joint, since pressure on the cartilages in the presence of infection probably encourages their necrosis. When aspiration treatment fails, or is unsuitable, what would seem to be the best plan of treatment in acute pyarthrosis of the knee is free incision into both sides of the joint, without introducing any mechanical drains, traction to separate the joint surfaces with the knee slightly flexed on a posterior splint and the extremity suspended, removal of the traction and splint once daily or oftener for a few minutes of gradually increasing active movement in bed or, better, employment of a suspension device that does not prevent joint motion.

DOCTOR BRICKNER called attention to a two-stage method of amputation in cases of knee-joint sepsis that was employed by Doctor Blake during the war, but only recently published (*American Journal of Surgery*, April, 1925). The first stage consists in an amputation through the joint, *i e*, merely cutting through all the soft tissues, the second stage—amputation through the lower third of the thigh—is performed after the infection has subsided and the tissues are clean, thus avoiding the great risk of osteomyelitis and soft-part infection of the stump. At first blush it might appear that the Mayo operation, referred to by Doctor Fischer in this discussion, would accomplish the same purpose as the first stage of Blake's method. In fact, however, the Mayo operation has proven a failure and has been largely abandoned because it does not drain the infected tissues behind the knee.

DOCTOR BRICKNER asked Doctor MacGuire to tell something of the early results as to mobility after operations for patella fracture. The speaker had tried various periods for instituting movement, but after all methods he had employed it took a great many weeks to restore a range of flexion approaching ninety degrees. Stiffness was a troublesome feature whether or not motion was started early and whether the joint was bandaged in extension or in slight flexion.

DOCTOR MACGUIRE, in closing the discussion, said that operation was per-

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formed as soon as possible after admission. There was a forty-eight-hour interval for preparation. Sometimes it was four or five days before operation could be performed, but this was not through choice. If the interval was not necessary for the preparation and for taking the X-ray, operation would be done twenty-four hours after admission.

As to early motion he was not against early motion, but the capsule requires time to go through granulation. He thought the Willems' treatment was ideal, but is usually difficult to institute. If one could accomplish what Doctor Farr did with the case shown earlier in the evening, it would be the method of choice. But one occasionally gets those results without the Willems' treatment. The patients will not cooperate, and it must be remembered in the metastatic cases that one is often dealing with general sepsis. If the cartilage is injured ankylosis will result. As far as the Mayo operation is concerned, the speaker had tried it and it was a complete failure. He disagreed with Doctor Fischer about irrigation, for one can irrigate the surface wounds only. As to Doctor Brickner's remarks as to stiffness in fractured patellas, he did not get it. Extension is complete in two weeks, and these patients are walking with a cane in three weeks and have flexion to 90° in three to four weeks.

Stated Meeting Held February 24, 1926

The President, DR WALTON MARTIN, in the Chair

ANGIOFIBROMA OF ILEUM WITH INTUSSUSCEPTION

DR RICHARD LEWISOHN presented a man, forty-nine years old, who was admitted to Mount Sinai Hospital, May 20, 1923. He had complained of cramps in the upper abdomen for six weeks. He had vomited for two days prior to his admission. No hæmatemesis or melæna. Physical examination and X-ray pictures of his stomach were negative. No definite diagnosis was made. He went home June 1.

He was readmitted to the hospital one week after his discharge. He had vomited for the previous five days. He showed slight distention without visible peristalsis. No signs of fluid. An extra-rectal mass was felt in the cul-de-sac.

Two days later peristalsis was visible. A small sausage-shaped mass was felt in the right lower quadrant. It was freely movable. The rectal mass had disappeared. X-ray pictures showed hugely dilated coils of small intestine, indicating an intestinal obstruction.

Operation under gas-ether anæsthesia revealed an intussusception of the ileum, about 12 inches long. At the head of the intussusception, a pedunculated hard tumor (size of a golf ball), was palpable.

The intussusception was easily reduced. The intestine was incised in a longitudinal direction and the tumor was removed. The incision was closed transversely with two rows of catgut. Closure of abdomen in layers without drainage. Microscopical examination showed the tumor to be an angiofibroma. Patient was considerably distended during the first three days. The distention was relieved by lavage, enemas and pituitrin. He made a perfect recovery. He was discharged July 3.

It is safe to assume that the intussusception occurred soon after his first discharge from the hospital.

STRANGULATED INGUINAL HERNIA RESECTION OF GANGRENOUS TRANSVERSE COLON IN PATIENT EIGHTY-TWO YEARS OLD

DOCTOR LEWISOHN presented a man, eighty-eight years old, who was admitted to Mount Sinai Hospital, December 7, 1920, with the following history. He had had a bilateral inguinal hernia for forty years. Both herniæ were always easily reducible. Six hours before his admission he noticed distention in both herniæ with acute pains. He vomited twice. No flatus was passed since the onset of the illness. Upon admission (10 30 P M.) he showed two very large inguinal herniæ. The right side (size of a foetal head) was hard and very tender. The left side showed a soft distention. Operation done seven hours after onset of pains, under gas and oxygen anæsthesia, revealed a gangrenous transverse colon about six inches long. After the relief of the obstruction, the gangrenous transverse colon with the corresponding part of the omentum was resected. The two halves of a large Murphy button were inserted into the lumina in order to expedite the operation. Both ends were closed in three layers and a side-to-side button anastomosis was performed. The peritoneum was closed with catgut, after a small tube had been inserted into the peritoneal cavity. The skin was closed with silk sutures. No attempt was made to effect a radical cure.

The tube was removed December 15. On December 20 the patient suddenly had a severe chill with a rise of temperature to 103° . His respirations went up to 36. He had marked dyspnoea and dullness and diminished breathing over the right base. His lung symptoms subsided in a few days.

The button was removed from the rectum ten days after operation.

He left the hospital January 3, 1921, and has been in perfect health since the operation.

DOCTOR LEWISOHN presented the patient in order to show that even in advanced years primary resection of the intestines can be performed with perfect recovery.

PRIMARY LYMPHO-SARCOMA OF THE SPLEEN

DR WALTER A. SHERWOOD presented a woman of fifty-six years of age who entered the Brooklyn Hospital because of weakness, loss of weight and the presence of an abdominal tumor, which had first been noticed two years previously.

On examination, there was a large, firm mass filling the left side of the abdomen and flank. It extended from the upper limit of the abdominal cavity well below the umbilicus, and corresponded to the outlines of an enormously enlarged spleen. The liver was of normal size and the patient was not jaundiced. There were a few scattered hard lymph-nodes in the inguinal and cervical regions, and one of these removed for biopsy showed nothing other than inflammatory changes. The patient had lost considerable weight and looked cachectic. The urine was negative and examination of the blood showed 60 per cent of hæmoglobin, 3,720,000 red cells, 23,700 white cells with 74 per cent polymorphonuclear, 24 per cent small lymphocytes and 2 per cent large lymphocytes. A liver function test was of no value.

January 29, 1926, the abdomen was opened through a long right rectus incision. The tumor was found to be a very large nodular spleen of firm consistency and adherent to the diaphragm above and to all surrounding structures. There was marked perisplenitis in all directions. After separation of the adhesions, the tumor was readily delivered, its pedicle ligated and the mass removed. Except for a small subserous myoma of the uterus, no other pathology was found.

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The patient made a prompt and satisfactory recovery, and since leaving the hospital has gained seven pounds in weight and feels and seems perfectly well.

Subsequent X-ray studies of the chest showed no evidence of metastases.

Pathological Report—Weight of tumor 1,650 grams. Measurements, 29 cm length, 15 cm width, 13 cm thickness.

The surface of the tumor is covered with large yellowish nodules from one to four cm in diameter. On section, very little splenic tissue is seen, this being replaced by soft yellowish-gray growth consisting of confluent nodules.

Microscopic section showed immature lymphocytosis with numerous mitotic figures. There are extensive areas of necrosis. The appearance of the specimen both in the gross and microscopically is typical of lymphosarcoma and, according to the pathological classification of splenic sarcomata, this is the type which does not metastasize early.

SARCOMA OF INTRA-ABDOMINAL TESTICLE

DR. WALTER A. SHERWOOD presented a man, twenty-four years of age, who entered hospital because of severe pain in the right lower abdominal quadrant and sacral region. He had been having attacks of pain for five months previous to his admission. He states that he has had an enlarged abdomen for several years.

On examination, he was found to have a large firm mass about the size of an adult head which filled the lower right side of the abdomen. The tumor seemed fixed, especially the lower portion of it, was slightly nodular, and in places seemed semi-fluctuant. Further examination revealed the fact that the both testicles were undescended.

The patient was submitted to complete X-ray and urological studies with the following result: Constriction of the right ureter with moderate hydronephrosis, probably due to outside pressure. The ileum was massed against the caecum which was dilated and pushed upward, probably also from pressure.

December 12, 1925, the abdomen was opened through a long right rectus incision, exposing a large irregularly shaped tumor about the size of an adult head. Although it appeared to be intra-peritoneal it was covered in front by a thin layer of parietal peritoneum and was attached by a broad base to the site of the internal inguinal ring. Numerous loops of bowel were adherent to it above and the bladder was attached to its lower and inner surface. The bladder, intestines, and all adhesions were carefully separated, the tumor was dissected away from its base at the site of the internal ring and the whole mass readily removed. Considerable bleeding from numerous large veins was easily controlled. The raw surfaces were covered by suturing the peritoneum. The left testicle was found entirely within the abdomen. It was of normal size and contour. The patient made a prompt and satisfactory operative recovery.

Pathological Report—The specimen is a large neoplasm measuring 16 x 14 x 13 cm. The anterior surface is covered with large veins and a thick white icing. The growth is well encapsulated. On section a small cyst was found, 5 cm in diameter, which contains chocolate brown fluid. The remainder is solid and fleshy in consistency and yellowish-white in color. There is a suggestion of testicular tissue in the lower portion of the tumor, surrounded by areas of yellow and green necrosis.

Microscopical section shows a malignant growth with alveolar arrangement. The alveoli contain large conical cells not unlike epithelial cells. There is a considerable amount of stroma. Necrosis is seen everywhere. No normal testicular structure is found.

While the examination of the section suggests large round cell sarcoma, the tumor in all probability belongs in the class of so-called teratomata

DR WALTON MARTIN said that this type of tumor had the interesting peculiarity of apparently disappearing under X-ray treatment. He had seen several very large inoperable tumors of this character disappear in this way, but after a variable length of time they all recurred.

DR ALEXIS V MOSCHCOWITZ said that in his experience, the condition as presented by Doctor Sherwood is a very rare one, in spite of the fact that it is usually stated in text-books that one of the great dangers of undescended testis is malignant degeneration.

With reference to X-ray therapy in these cases, as stated by Doctor Martin, Doctor Moschcowitz mentioned a patient who is now under observation in Mt Sinai Hospital. The man had a seminoma of the right descended testis and peculiarly, very large intra-abdominal metastases to the left of the spinal column.

The tumor was ablated, and subsequently the patient was turned over for X-ray therapy, under which the tumor gradually disappeared. He was presented at one of the Mt Sinai Hospital clinical conferences as a remarkably good result of X-ray therapy. He returned to the hospital about three months ago with a large hernia on the left side. Doctor Moschcowitz operated this hernia and the ring was so large that he was able to introduce a hand into the abdomen for the purpose of palpation, and numerous very large metastases were found, showing that either they were mistaken in the excellent therapeutic result of the X-rays or that the results were only temporary.

DR JOHN DOUGLAS said that before giving the X-rays all the credit for the improvement in Doctor Moschcowitz's patient he wished to cite one case. Seven years ago he went on duty at Bellevue Hospital where there was a case which had been operated on for a large abdominal tumor. The tumor was so large that it had caused pressure on the sigmoid and rectum, and at operation the intestine was injured and the patient developed a fecal fistula. The man was apparently hopeless and the speaker did not examine him carefully until it was noticed that he was getting better. Then he carefully examined and it was found that he had a tumor of the testicle. The abdominal tumor was getting smaller. The testicle was removed and the man was discharged having gained thirty pounds in weight and no abdominal mass could be felt. Apparently all the metastases had disappeared. Less than a year afterward he was admitted to one of the medical wards with recurrence. He died shortly afterward. Another man was operated on for a small seminoma of the testicle about a year ago. There were no enlarged glands or evidences of metastases. He went home to Richmond, had abdominal pain, was treated with X-rays and died last month, a year after operation, with metastasis in the lungs, all through the abdomen and a large one in the region of the kidney. These tumors of the testicle are evidently very malignant.

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DR JOSEPH WIENER said that a few weeks ago he was called to see a patient who had been tapped for hydrocele and found a tumor in the scrotum. This was diagnosed as malignant and removed. A few days later he obtained the man's history. He was then twenty-eight years of age, and until the age of twenty-six the testis had been intra-abdominal. At twenty-eight he had sarcoma.

CANCER OF RECTUM EXCISION IN 1911 LATE RESULT CHRONIC ASCITES AFTER THIRTEEN YEARS NO LATE METASTASIS TALMA OPERATION CURE

DR WILLY MEYER presented a man, who fifteen years ago, at the age of thirty-two, years, had carcinoma of the lower portion of the rectum inclusive of the anal ring. Radical extirpation was done. There was no preliminary colostomy. The anal sphincter muscles having been completely removed the stump was left one-half inch below the level of the skin and the wound allowed to granulate and cicatrize around the rectum. The patient made a good recovery. The pathological diagnosis was adenocarcinoma.

In December, 1924, he came under the speaker's care again with a tremendous ascites, anasarca of the abdominal wall, and extreme swelling of both lower extremities. At the anus was a circular, not constricting cicatricial opening which was too small for a finger to pass through, but which did admit the tip of a fountain syringe which was used every morning and the large intestine washed out. In this way he kept clean during the day and was not annoyed in the least. He had lived comfortably this way until this pronounced ascites had developed. Having been received into the hospital tapping evacuated seven quarts of fluid, which contained no cellular elements. The liver was not enlarged, in fact it seemed to be smaller than normal. The spleen too was not enlarged. There were no palpable nodular masses in the abdomen. He was not addicted to alcohol, had had no specific disease, and no malignant disease appeared to be present. Careful X-raying of the gastrointestinal tract revealed a band which pulled the greater curvature of the stomach up and a condition suspicious of malignancy. By abdominal section, several more quarts of fluid were removed. Further exploration of the abdomen failed to reveal any trace of malignancy. The liver was smaller than it is normally and was slightly granular. A Talma operation was done. The lower part of the peritoneal wound was left open, a piece of omentum pulled through, fastened to peritoneum and subcutaneous tissue and then the opening in the skin closed. To hasten anastomosis the abdomen was exposed to superheated air, with an electric cradle for half an hour every day. Before he was discharged in February he had to be tapped once more, three weeks after the Talma operation. After returning home his wife carried out the treatment with superheated air. The ascites decreased gradually, but continually. He is now entirely well and has returned to work. There is no sign of malignancy. As to the cause of the ascites as it must be referred to, some kind of chronic hepatitis, not due to alcohol nor late malignancy nor syphilis. The fact that there is not a trace of fluid in the peritoneal cavity at present speaks definitely against a ventral, intrahepatic form of malignancy of slow growth.

OSTEOMYELITIS OF FEMUR

DR JOHN A. HARTWELL presented a patient whom he had shown before the Society, April 12, 1922. (See ANNALS OF SURGERY, vol lxxvi, pp 289-290.) At that time the diagnosis was doubtful and he had requested suggestions as to the most advisable therapeutic measures. Doctors Hitzrot and Whitman stated their belief that the patient's lesion was a low grade infectious

osteomyelitis of the femur and advised operative intervention. Doctor Meyer expressed the opinion that the condition impressed him as tuberculosis of the bone upon a congenital luetic basis.

The patient was returned from the meeting to the hospital where she continued to run a fever varying between 99° and 100° . By August 18, 1922, there appeared a small abscess on the inner aspect of the right lower thigh. This was incised and one ounce of thick yellowish purulent exudate evacuated. The culture of this pus showed a pure growth of *staphylococcus aureus*. A thirteen centimetric sinus was found to extend upward and posteriorly from the opened abscess, but a communication with bone was not demonstrated. X-ray at this time showed a marked osteomyelitis of the entire shaft of the right femur with irregular new bone formation. There was evidence of small cloacæ at the junction of the upper and mid-thirds in the posterior aspect of the femur in the centre of which appeared a small sequestrum.

October 6, 1922, the lower six inches of the shaft of the femur was exposed through an eight inch incision on the anterior aspect of the thigh. The soft parts were moderately oedematous and the periosteum greatly thickened. Upon reflecting it from the bone, the latter presented an irregularly moth-eaten appearance and a definite sinus about two inches above the upper limit of the knee-joint. The marrow cavity was exposed by removal of the anterior cortical bone and several sequestra extracted. The sinus opening on medial aspect of the lower thigh was found to communicate with a cloaca in the lower third of the femur posteriorly. The wounds were irrigated with Dakin's solution by the Carrel technic. Healing was rapid and complete except for two small sinuses. X-ray showed two sequestra as the causative agents of these sinuses. November 21, 1922, four sequestra, each about 2 cm. in length, were removed by reopening wound of preceding operation. Following this the wound granulated satisfactorily and healed completely by January 18, 1923. From then until now, it has remained healed and she has been able to follow her occupation as stenographer without interruption. Flexion at her right knee is restricted to 75° .

DR WALTON MARTIN said that the incision used by Doctor Hartwell had been referred to in an article on the "Anatomical Approach to Long Bones" by Professor Thompson eight or nine years ago as the incision of choice for exposing the shaft of the femur.

DR FREDERIC W. BANCROFT said that a year ago he had a case of osteomyelitis in a woman who had been operated on in Italy twenty years previously by the incision on the anterior surface of the thigh as described by Doctor Hartwell. She had been well during all this time until last fall when she had an acute recurrence of the old process in the femur.

ROUX Y GASTRO-ENTEROSTOMY

DR CHARLES L. GIBSON presented a woman aged forty-nine years who had suffered from severe stomach manifestations for many years. Fourteen years ago a gastrostomy was performed, following which she was improved until four years ago, when recurrence of troubles necessitated a posterior gastro-enterostomy. Little relief, and in past three months conditions worse than ever, vomiting daily.

On admission to the Medical Division, New York Hospital, she was greatly emaciated, vomiting frequently, and there was apparently complete pyloric obstruction. Imperfect fluoroscopy showed an enormously dilated stomach with nothing passing into the duodenum.

Operation January 27, 1926 Local anesthesia of abdominal wall Six inch incision through the scar in the right rectus muscle The abdomen was filled with adhesions, particularly of the anterior portion of the stomach to the abdominal wall and the stomach, duodenum, liver and gall-bladder presented diffuse matting from adhesions Passing to the left side of the abdomen, access to the posterior wall of the stomach was obtained through a slit in the gastrocolic omentum The no loop gastro-enterostomy found to be entirely closed As it was not possible to use the transverse mesocolon on the anterior wall of the stomach, the latter was pulled out through a slit in the gastrocolic omentum and the ileum divided about eight inches below the site of the gastro-enterostomy Distal end implanted into the side of the posterior wall of the stomach Enteroanastomosis made by passing half a Murphy button down this leg, connecting it with the other half in the proximal portion with purse-string suture Gastro-enterostomy made with aid of clamps Five rows of sutures—all catgut Time one hour fifteen minutes

Convalescence was absolutely uneventful Patient never vomited and was put on a fairly liberal diet quite early She was allowed up on the twelfth post-operative day and went to the country on the eighteenth post-operative day She had already gained ten pounds

This case is one calling particularly for unusual procedures and the situation was effectively met by a Roux gastro-enterostomy using the gastrocolic omentum for access to the posterior wall of the stomach

CHOLECYSTENTEROSTOMY FOR CARCINOMA OF THE BILE DUCTS

DR CHARLES L. GIBSON presented a man age sixty-three years, who was admitted to hospital with rather vague history of having had chilly sensations and slight feeling of nausea for about two weeks Recently the stools have been light colored, urine dark, and jaundice was noted Icterus index first 107, second 103 Liver function test showed dye retention of 100 per cent Graham test showed no signs of visualized gall-bladder Fluoroscopic examination of stomach and duodenum negative

Operation November 17 1925 Oblique incision Gall-bladder was tense, thin and adherent at its lower portion to the omentum Palpation showed no stones On the anterior surface of the gall-bladder was a localized thickening of the wall It could be distinctly seen and felt It was quite firm and about a half inch in diameter In the common duct, just below the cystic duct was a similar thickening, also apparently in the wall Believed that the condition was one of carcinoma of the ducts and gall-bladder, therefore cholecystectomy unsuitable Cholecystenterostomy was done, using the jejunum about twelve inches from its origin Five rows of suture, three posterior two anterior all of fine chromicised catgut Closure of the wound without drainage

Except for an acute bronchitis with distressing cough convalescence was smooth Allowed up on the fifteenth post-operative day and sent to the country on the twentieth post-operative day At that time the jaundice had all disappeared and patient was very well Icterus index 26

Seen January 20, 1926 Feels absolutely well

The fact that the patient has improved so very distinctly must necessarily raise some doubt as to the nature of the obstructive process Owing to the mechanics of the condition, namely involvement of the wall of the common duct, it seemed as if there could be little doubt as to the advisability of the procedure employed Anastomosis of the biliary passages to the intestine have been satisfactory in the reporter's hands Contrary to the practice of most operators, he does not attempt to make an anastomosis between the biliary passages and the duodenum, as the operation is more difficult and there is more

CHOLECYSTECTOMY WITHOUT DRAINAGE

strain on the suture line, jeopardizing its integrity. He had performed quite a number of these anastomoses, using the jejunum, bringing it up in a loose loop anterior to the colon. He knew of no instance where there had been any infection of the liver. In one case, certainly, ten years after operation there was no evidence of any trouble.

The society may remember the presentation of a case of anastomosis of the hepatic duct with the jejunum at the meeting in January, 1922. The patient is still, five and a half years after operation, in perfect health.

DR ALEXIS V MOSHCOWITZ said that the subject of cholecystenterostomy for carcinoma of the common duct and the head of the pancreas has been frequently discussed at the meetings of the New York Surgical Society. Personally, he had refrained from discussing it before, but the operation did not appeal to him, and he did not believe it was frequently justified. He always tried to make the diagnosis in advance, and when he could, with a fair degree of certainty, make a diagnosis of carcinoma of the common duct or of the head of the pancreas, he did not operate at all. These patients do not stand even an exploratory operation well. The case Doctor Gibson presented, however, was perfectly wonderful but personally whenever the speaker had performed this operation for this condition he had always regretted it.

CHOLECYSTECTOMY WITHOUT DRAINAGE

DR CHARLES L GIBSON presented a woman, aged twenty-eight years, who was admitted to hospital November 10, 1924, and subjected to operation November 13, by a six inch incision running well up in the epigastrium, which exposed a gall-bladder enlarged, thickened, filled with large stones, the site of a recent inflammation, especially noticeable at its neck, where all the structures were found fused into an inflammatory mass. Retrograde cholecystectomy was done after exposure of the ducts. The cystic duct was divided separately by cautery. The gall-bladder shelled out of its bed with little bleeding, the fissure of liver was sewed together to stop any oozing. Operative field left perfectly dry. Stump of cystic duct covered by flap of gastro-hepatic omentum, ligatures on the duct being led through this structure.

Recovery was remarkably serene and quiet and rapid. She was up on ninth post-operative day. Home on eleventh post-operative day. Wound healed by primary union.

Follow-up Note—February 18, 1926. Gained twelve pounds in weight. Looks exceedingly well. No complaints. Excellent. No hernia.

A second case was presented in the person of a woman, aged twenty-six years, who was admitted March 27, 1925.

Operation was done April 4, 1925—Oblique incision parallel to right costal margin. Gall-bladder somewhat thickened and irregular and contains numerous stones. Easily removed by retrograde cholecystectomy. There was no oozing and gall-bladder bed was closed by suture. Stump of cystic duct divided by cautery and buried in small flap of gastrohepatic omentum. Appendix pathological and removed. Closure without drainage.

Convalescence—Complicated by some nausea and indigestion for first five or six days. This, however, cleared up and patient was discharged cured on twelfth post-operative day.

Follow-up Note—February 18, 1926. Excellent result. No complaints. No hernia.

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AIDS TO CHOLECYSTECTOMY

DR CHARLES L. GIBSON read a paper with the above title, for which see page 618

DR ALEXIS V. MOSCHCOWITZ said he had a profound admiration for anybody who ventured to do cholecystectomy without drainage. Personally he never did it, for he was very old-fashioned. He remembered a time when one of his associates was operating on two gall-bladder cases and exclaimed, "Some day I am going to have courage enough to close up a gall-bladder case without drainage." It was just as well he had not yet acquired this courage for both these cases he was then operating on were later followed by profuse drainage of bile. It would certainly have been wrong to have closed them. Doctor Moschcowitz said his patients are usually discharged at the end of the fifteenth to the seventeenth day with the wound completely healed, even though drained, he therefore sees no reason for changing his method of procedure.

DR DEWITT STETTEN said that he was in complete agreement with all that Doctor Gibson had said. He was particularly interested in the question of cholecystectomy without drainage, and had recently published a brief paper on the subject (*Surgical Clinics of North America*, April, 1925, vol. v, No. 2, pp. 489-498). Although he was aware that the consensus of opinion was against this procedure, he felt that in suitable cases it was preferable to drainage. Without going into detail, a few of the most obvious advantages might be mentioned, such as avoidance of post-operative peritoneal adhesions, diminishing of the danger of post-operative ventral hernia, less complicated conditions if the necessity for re-operation arises, simplified after treatment and more rapid convalescence, less discomfort to the patient and avoidance of reaction from drain removal such as rise of temperature, or pulmonary infarct which Doctor Stetten has noted in one case, and finally avoidance of retention after drain removal which he has observed in several instances. His efforts have been directed toward developing a technic which would make the closure without drainage after removal of the gall-bladder as safe as possible, and this has been accomplished by the formation of a triangular peritoneal flap from the gall-bladder to cover the cystic duct stump. This flap is included in the peritoneal suture of the liver bed of the gall-bladder. The cystic duct stump is thus sealed in such a way that if the ligatures should be exploded from the cystic duct stump, which is after all, the main danger of closure without drainage, the worst that could possibly happen would be a subhepatic extra-peritoneal accumulation of bile. This could cause no serious disturbance, and could readily be taken care of if necessary. Doctor Stetten is certainly opposed to the taking of unjustifiable risks, and it must be admitted that, in a large number of cases, closure without drainage is inadvisable. Roughly in Doctor Stetten's personal experience, about 50 per cent of his cases required drainage. The speaker has performed the operation without drainage in about 100 cases since he first began using this technic and has had no trouble in any case. Doctor Stetten also wishes to register his approval of Doctor Gibson's attitude in regard to the performing of cholecystectomy from above downwards. He

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feels that this is the logical method, permitting of traction and better exposure of the deeper parts, and that the removal of the gall-bladder from the cystic duct upwards is unsound and dangerous, as it exposes the hepatic and common bile ducts to possible injury

DR JOHN A HARTWELL said he was reminded of what Doctor Judd had said of cholecystectomy without drainage "It is a questionable procedure even though I have had no trouble with 1500 cases on which I have operated without drainage" Nevertheless, Doctor Hartwell could not see that it had any advantages to overcome the great risk it entailed and which all surgeons feared It was perhaps advantageous if the gall-bladder was not inflamed or only slightly so and one had stones only to deal with But there is almost always inflammation present and the trauma necessary in performing the operation may be sufficient to start up increased inflammation, and as a result there is a swelling in the common duct and temporary obstruction and back damming into the liver One is not giving drainage which ought to be in the biliary tract during healing Doctor Hartwell goes through the anterior sheath of the rectus, draws the entire rectus outward, and makes an incision through the posterior sheath just outside the midline This makes a good exposure and the incision may be made long enough to easily reach the appendix The whole innervation of the muscle is left intact and hernias have been rare If drainage is necessary it is done through a stab wound in the flank, and any leakage is carried off through this opening Both wounds are healed at the end of three weeks

DR JOSEPH WIENER said that if local anæsthesia is used the field can be widened, also the percentage of the morbidity and of the mortality can be lowered He had recently successfully performed a secondary cholecystectomy, using local anæsthesia, on an old lady of seventy-six, who had undergone cholecystotomy some years before There is a difference in the cases The 1500 cases of Judd were not acute In cases occurring in fat women of middle age, where acute inflammation is almost always present, it is impossible to make closure without drainage There is little trouble from drainage if it is done in the proper way For the last few years the speaker's drain has consisted of a rubber glove slipped up against the liver The objection to the rubber dam is that it is often old and brittle, but the rubber glove can always be fresh and soft As regards the incision For the last ten years Doctor Wiener has used the cross incision No hernias have resulted, it is not difficult to remove the appendix, which he does in 75 per cent of his gall-bladder cases, there is less morbidity, no post-operative obstruction of the bowel, no difficulty in pushing the small intestine back at the close of the operation, because the small intestines are neither seen nor handled if a cross incision is made

JOINT MEETING OF THE PHILADELPHIA ACADEMY OF SURGERY AND THE NEW YORK SURGICAL SOCIETY

Held at the Jefferson Hospital, Philadelphia, February 10 1926

DOCTOR CHARLES F MITCHELL, President of the Philadelphia Academy,
in the Chair

LARYNGECTOMY FOR CARCINOMA OF THE LARYNX

DR FIELDING O LEWIS presented six cases in which he had performed total excision of the larynx for carcinoma. The longest time that had elapsed since operation was four and one-half years. The most recent case was operated upon February 6, 1926. Three of the six patients were able to talk sufficiently well to make themselves understood. All of the three said that they were able to talk better after a large meal. The technic of the operation was illustrated by lantern slides. The operation in each instance was done in one stage, and rectal anæsthesia was used routinely.

DR CARL EGGERS of New York, discussed Doctor Lewis' presentation and said that as a general rule he favored the two-stage operation especially where there was involvement of the lymphatics of the neck. He thought that perhaps laryngological surgeons did not have quite the same conception of lymphatic extension of malignancy as the general surgeon. He added, however, that Doctor Lewis' results spoke for themselves.

TULAREMIA

DR JOHN B FLICK read a paper entitled "Tularemia," containing a report of two cases.

SYPHILIS OF THE STOMACH

DR J STEWART RODMAN presented a colored man, aged fifty-two years who was admitted to the Woman's College Hospital November 9 1925, on account of pain in stomach with vomiting for the past four months. Has lost 40 pounds in weight in the four months. Is afraid to eat on account of the pain. Bowels move regularly.

Abdomen—Skin very dry and thin. No subcutaneous fat. Liver margin palpable two fingers below costal margin. There is a suggestion of a mass in the midline and just to the right and below the liver. Very tender over this same area. No rigidity, no other masses felt. Extremities negative but very thin. Reflexes negative. Wassermann—4 plus.

X-ray showed the greater curvature of the stomach in its upper half marked irregularity in contour, with a narrowing of lumen, evidently due to a pathological process. There is extreme tenderness over this area. The pylorus appears to be normal. The duodenal cap is large, with a filling defect on its upper border and with adhesions about the duodenum. There was no obstruction to the passage of the meal, but rather a hypermotility of the entire tract, as the whole meal was evacuated in about twenty-four hours. November 16, 1925, a laparotomy was done. On exposing the stomach it was found to be entirely occupied by a new growth from cardia to pylorus. Stomach was contracted, the growth felt hard and smooth. There was no glandular involvement either along the lesser or greater curvature. No evidence of metastasis to the liver or other abdominal viscera. Because of the fact that the entire stomach was apparently involved in the tumor mass, that the

SIMULTANEOUS BILATERAL MAMMARY CANCER

patient's condition did not warrant a total gastrectomy, and that it seemed necessary to feed him, a jejunostomy was done. The patient left the operating table in good condition.

Post-operative Record—After the fourth post-operative day, the patient began to feel most comfortable feeding through the jejunostomy opening having been started on the second day. At this time he was put on mixed treatment of bismuthide of mercury gr 1/32, potassium iodide gr 10, three times daily. His improvement began almost at once and at the end of two weeks following operation he was able to take a semi-liquid diet without pain. His condition continued to improve and a second X-ray was taken six weeks after operation, at which time he was eating soft diet without any discomfort. This second X-ray showed a very marked improvement in that the tumor mass was apparently greatly reduced in size, and in fact the stomach, although contracted, filled with bismuth throughout. He was discharged from the hospital on the 30th day of December, 1925.

On the day of this report, February 10, 1926 his improvement has continued. He has gained about twenty-five pounds in weight, is eating any kind of food and digesting it without pain and his jejunostomy opening is closed.

In comment the speaker referred to the paper of Doctor Hartwell in the ANNALS OF SURGERY for April, 1925, in which Doctor Hartwell has reviewed the literature and finds since the original report of Andral in 1834 of two cases, that there have been some twenty-three others in addition to those reported by G. B. Eusterman in 1923 from the Mayo Clinic. Chiall, in 1891, in reporting two cases and in collecting seven from the literature, stated that it was his belief that only histological proof of syphilis of the stomach should be accepted. Since that time the Wassermann and X-ray have been perfected and is more to be relied on at the present time, in the writer's opinion, than histological findings in so far as syphilis is concerned.

This case is reported, therefore, as an instance of syphilis of the stomach because of (1st) the fact that he unquestionably had a tumor of the stomach as proven by clinical history, X-ray and operative findings (2nd) That he had a positive Wassermann, it being 4 plus (3rd) That the X-ray findings were characteristic, and (4th) of his rapid improvement under anti-syphilitic treatment.

SIMULTANEOUS BILATERAL MAMMARY CANCER

DR EDWARD J KLOPP presented a woman, sixty-three years of age, who noticed a lump in the left breast in March, 1924. At examination April 16, there was found in the left breast a small hard, movable nodule, about 3 cm in diameter, in the upper outer quadrant of the left breast, no palpable nodes in the corresponding axilla. A similar mass was found in the right breast partly beneath and to the left of the nipple. She had no knowledge of this second tumor. The right axilla also was free of palpable nodes. The breasts were smaller than the average.

There had been no pregnancies. Menopause at forty-five with no unpleasant symptoms. X-ray of her chest showed no evidence of pulmonary metastasis.

May 14, the left breast was removed by the Stewart technic, twelve days later the right was likewise removed. The pathological report stated that the microscopic appearance of the tumor from both breasts of this patient shows a very marked similarity in type. They are both adeno-carcinoma, and

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the picture strongly suggests duct origin. The axillary glands of both specimens showed no microscopical evidence of metastasis.

This undoubtedly is a case of simultaneous cancer of both breasts, said to occur about once in five hundred cases.

IMPERFORATE RECTUM WITH VESICAL OUTLET

DR EDWARD J. KLOPP presented a male child, born June 26, 1925. Birth was spontaneous. It was the sixth child. No other malformations in the family. The following day the baby was referred to the reporter at the Pennsylvania Hospital where it was admitted in Doctor Gibbon's service. The child had an imperforate anus. There was no anal dimple. The urine contained meconium. There was no discharge of meconium when the child did not void. Vomiting had not occurred.

The child was operated upon thirty-eight hours after birth. The perineum was infiltrated with $\frac{1}{2}$ per cent procain. An incision was made in the midline extending from the scrotum to the coccyx. The sphincter muscles could not be identified. Continuing upward for at least seven cm., he failed to find bowel. Crying and struggling caused some bulging from above, but not sufficient to definitely identify large bowel. Neither did he find the communication between the bowel and bladder.

Sigmoid colostomy was done and the bowel was brought to the surface of the abdomen with difficulty, as it seemed to be fixed below. The bowel was opened and a large catheter inserted. There was a copious discharge of meconium. The catheter was removed in three days. The perineal incision was allowed to close.

Feeding presented a difficult problem. Digestion was poor, but he began to gain consistently in September, and was referred to the X-ray department for the purpose of determining the location, position and contour of the blind pouch. The roentgenologist reported that the lower opening in the colostomy corresponded with the proximal loop of the bowel. At operation it was intended to bring the bowel up without twisting or changing its direction.

December 30, with a catheter in the rectal pouch an incision was made in the perineum and dissection carried upward until the catheter was felt through the bowel. After freeing it as much as possible it was brought down, opened and sutured to the skin.

The X-ray films with catheter in both proximal and distal loops shows that the afferent and efferent portions are close together for 3 cm.

January 25, 1926, a light hæmostat was applied to the spur between the two loops in order to crush the septum. Feces passed through the artificial anus five days later. The clamp was removed on the sixth day. X-ray with barium meal injected through the colostomy opening shows a slight narrowing about 6 cm. above the anus. Judging from the appearance of the shadow over the perineum there is no anal sphincter action.

The anus is about 1 cm. behind the normal location. It is doubtful whether anal sphincter action will ever develop, but is hoped that the levators will assume this function, at least in part. No attempt will be made to close the colostomy until it is found whether this procedure would be justifiable.

NERVE ANASTOMOSIS IN RECURRENT LARYNGEAL PARALYSIS

DR CHARLES H. FRAZIER read a paper entitled "A Review of Results of Nerve and Anastomosis in Treatment of Recurrent Laryngeal Paralysis."

FECAL FISTULA

DR JOHN B. DEEVER read a paper entitled "External Fecal Fistula Following Appendicitis."

BOOK REVIEW

THE PRACTICE OF UROLOGY By HUGH H. YOUNG, M.D., and DAVID M. DAVIS, M.D., with the collaboration of FRANKLIN P. JOHNSON, M.D.
Two octavo volumes Philadelphia and London W. B. Saunders Co., 1926

These two volumes represent, indeed, a monument to the director of the James Buchanan Brady Urological Institute, and show the results that may be obtained by the centralization of effort in a single branch of endeavor. Their publication has been impatiently awaited, and certainly will repay the reader in his search for authoritative information in any one of the multitude of ramifications and interdependencies associated with a study of phenomena connected with pathologic conditions relative to the urogenital tract.

The critical study of such an enormous amount of clinical material represents unremitting labor, but the tabulation of results is very lucid, concise, well systematized and readily appreciated. The arrangement of the subject matter has been made almost entirely on the basis of the pathology. Thus in the earlier part of the work the results of obstructive uropathy are exhaustively considered, while the recitation of operative procedure is deferred for subsequent consideration, thus eliminating repetition which would otherwise have occurred.

As must naturally have been expected, especial weight is placed on the personal achievements of the clinic and the justification of the many and various procedures, mechanical devices and original researches which have had their inception under the direction of the authors. A mere recitation of the many phases covered reads like an urologic index itself. One notes particularly the studies on the physiology of micturition, the various phases of acute and chronic cystitis, pyonephrosis and renal and ureteral calculus, pre-operative treatment of prostatectomy, etc. Various personal operative procedures as the special Bottini technic for middle lobe cases, perineal prostatectomy, punch operation, various cystoscopic operative procedures and the transperitoneal technic for kidney tumors with removal of the peritoneal covering are recited and illustrated in more than usual detail. The depiction and description of the uses of a multitude of original urologic instruments are most instructive. The efforts of Doctor Davis in developing a urinary antiseptic and the statistical presentation of the results of mercurochrome and meroxyl and the new antisyphilitic drug, flumein, and the efforts toward the obtaining of a therapia sterilisans magna are all taken up in detail and effectively.

The first volume, in addition to a consideration of the physiology of micturition and the lesions resulting from obstructions along the urogenital tract, devotes three chapters to infections and infestations, general, tubercular and

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syphilitic, while the subjects of urolithiasis prostatic hypertrophy and neoplasms complete it

The second volume is introduced by an exhaustive treatise on malformations and abnormalities of the urogenital tract covering 136 pages, chiefly the observations of Dr Franklin P. Johnson, whose especial aptitude and knowledge of embryology lends itself well to the proper consideration of this important subject. Chapter XII, on the diagnostic significance of special urologic symptoms is particularly interesting, and its careful reading will well repay one. Eight chapters are devoted to the operations on the kidney, ureter, bladder, prostate, seminal vesicles, scrotum and its contents, urethria and penis, respectively. All procedures are fully illustrated and the descriptive text adequate.

Interspersed throughout the two volumes in appropriate positions are many page inserts in colors showing the varying appearance of pathologic conditions in various stages, as might be seen through the cystoscope or urethroscope. They are particularly accurate and natural. The remainder of the one thousand illustrations are mostly original and show the conditions referred to perfectly. The drawings are the work of William P. Didusch and are very well executed.

The work of Doctor Young and his associates will prove beyond any question a very welcome and valuable addition to urologic literature reflecting and representing, as it does, the best American thought on a subject in which there has been such revolutionary advances during the last decade, and complementing the already noteworthy treatises of Watson and Cunningham, Guiteras, Chetwood, Keyes and Cabot.

JAMES T. PILCHER

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TULAREMIA^{*}

BY JOHN B. FLICK, M.D.

OF PHILADELPHIA, PA

THE fact that tularemia has been reported from many different sections of the country in the past few years and that it not infrequently escapes recognition for days or even weeks after coming under observation, makes it desirable that individual cases be brought before the attention of the profession.

Tularemia is a specific infectious disease due to the bacterium *tularensis*. The causative organism was discovered and named in 1912 by McCoy and Chapin of the Public Health Service, and identified as the cause of a plague-like disease of rodents, epidemic among ground squirrels in Tulare County, California. Francis¹ of the Public Health Service, who has made an extensive study of the disease and has contributed many articles to the literature, believes that the first reference to the disease in humans was made by R. A. Pearse in a paper read before the Utah State Medical Association, Salt Lake City, October 3, and 4, 1910. It remained, however, for Vail² and Sattler³ to observe the first human cases confirmed bacteriologically. These cases occurred in their ophthalmic practices in 1913 and 1914 and the bacterium *tularensis* was isolated in cultures by Wherry and Lamb from guinea-pigs inoculated with the conjunctival secretions. In Utah, the disease in man was for several years known as "deer fly fever," owing to the belief that the infection was due to the bite of the blood-sucking fly (*Chrysops discalis*), commonly found on horses. This belief in the agency of the deer-fly was crystallized into demonstration in 1919 and 1920, when Francis isolated bacterium *tularensis* from seven human cases and seventeen jack-rabbits and named the disease tularemia.

Tularemia occurs as a fatal bacteremia in various rodents, especially rabbits, and is transmitted to man by the bite of an infected blood-sucking insect or tick, or by the lodgement on the hand or elsewhere on the body of the blood or infected tissues of a diseased rodent, as may occur among marketmen, cooks, hunters or laboratory workers.

So far as is known tularemia is confined to the United States. It has been authentically reported from California, Utah, Wyoming, Idaho, Colorado, Ohio, Indiana, Tennessee, North Carolina, Montana, New Mexico, Virginia, West Virginia, the District of Columbia and Texas⁴. The two cases reported in this paper are from Maryland, the first as far as I am able to find, to be reported from this State.

^{*} Read at the Joint Meeting of the New York Surgical Society and the Philadelphia Academy of Surgery, February 10, 1925.

In an analysis of forty-nine cases Francis describes two clinical types of the disease, the glandular type and the typhoid type

In the glandular type the incubation period varies from two to nine days. The onset is sudden and manifested by headache, chills, pains, vomiting, prostration and fever. Following the local infection the patients complain within forty-eight hours after the onset, of pain in the area of the lymph glands which drain the site of infection, and on examination these glands are found to be tender and slightly enlarged. "The glandular pain precedes by about twenty-four hours any definite reference by the patient to the site of infection, which now becomes manifest as a painful, swollen, inflamed papule which speedily breaks down, liberating a necrotic core or plug and leaving an ulcer about one-fourth inch in diameter, with raised edges and having a punched out appearance. The fever lasts from two to three weeks, and may reach a height of 104° F" (Francis). The temperature may be sustained or there may be daily remissions. There may be a lymphangitis as well as lymphadenitis. In about half the cases the lymph glands break down. In the other half the glands remain hard, palpable and tender for two or three months, gradually returning to normal.

The blood count is not sufficiently disturbed to be of diagnostic significance, although the leukocyte count may be somewhat increased. Agglutinins for *Bacterium tularensis* are absent from the blood during the first week of the illness, but appear in the second week, reaching their height at the end of the third or fourth week. They then begin to decline but persist somewhat for several years. Agglutination is of diagnostic value and makes possible the differentiation of tularemia from typhoid fever and other infections during the febrile period. Convalescence is protracted. It is rare for a patient to be at work again at the end of a month. The patients finally recover without evident complications, although some require from six months to a year. Weakness in convalescence seems to be a conspicuous symptom. Death apparently is rare, although several deaths have been reported in the literature.

Practically all cases of the typhoid type have occurred in laboratory workers and without evident site of infection or enlargement of lymph glands. In all other respects the disease resembles the glandular type.

Cases of tularemia have been erroneously diagnosed anthrax, glandular farcy, typhoid fever, septic infection and in one case in which slight jaundice was present, cholangitis⁵. In our own cases one was diagnosed actinomycosis and the other bone-felon.

With a knowledge of the disease the diagnosis may be suspected on obtaining a history of contact with wild rabbits or of tick bite or fly bite, but cannot be absolutely established without laboratory aid. The serum of the patient after the first week gives a positive agglutination test which is reliable. Culture of the causative organism appears to be difficult. Inoculation of a guinea-pig with pus from the site of infection should produce death within a week with characteristic pathology. On examining the dead animal the lymph glands draining the area inoculated present a granular caseation. The spleen

is enlarged, and the spleen and liver are studded with great numbers of small white foci of necrosis

The treatment is symptomatic. If the glands break down they should be incised.

The two cases I wish to add to those already reported were admitted to the Jefferson Hospital on January 5, 1926. Their histories are as follows:

CASE I—B J, a white man aged forty-five, an American, married, a farmer living at Girdle Tree, Maryland, on November 12, 1925 while cleaning a wild rabbit which he had shot was struck in the left eye by something which he described as "cool and soft." Thirty-six hours later the left eye became inflamed and swollen, discharged a purulent material and was very painful. He consulted a local physician who treated his eye and relieved the pain somewhat. Twenty-four hours later a lump developed in the parotid region. That day he had a severe chill followed by a fever which ranged between 101° F in the morning and 103° F in the afternoon and continued for about three weeks. He promptly developed lumps in the left submaxillary region. Lumps gradually increased in size, at first firm and hard, they soon softened and skin over them became glossy. They were sore to touch. Patient suffered much weakness and exhaustion from second day and after three months had not yet fully recovered his strength. He lost considerable weight. The eye condition improved slowly and gradually cleared.

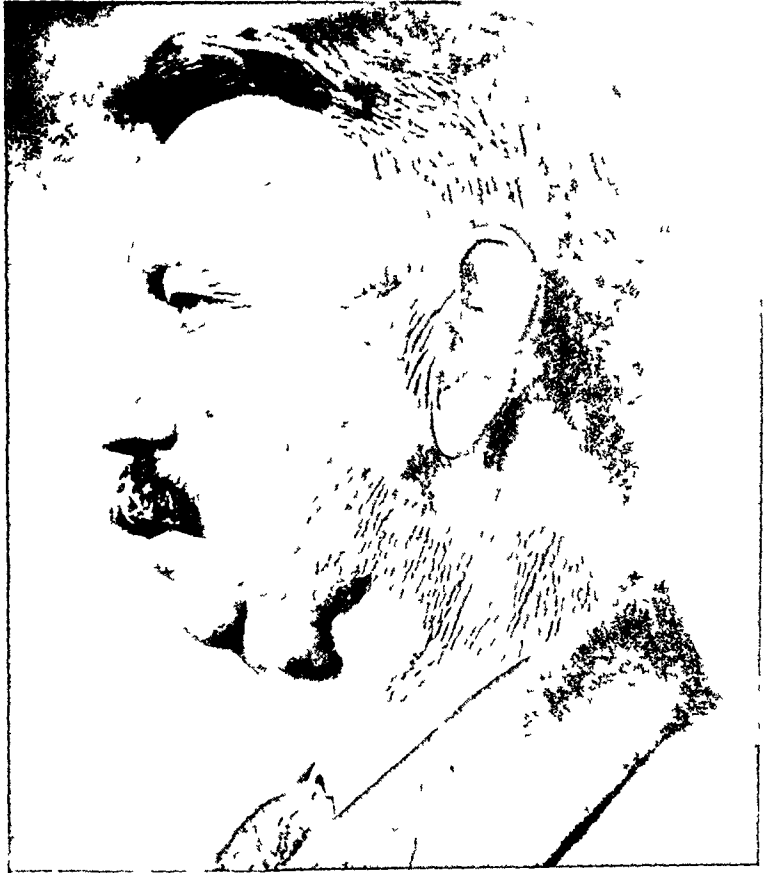


FIG 1—Showing the enlarged and broken down parotid and submaxillary lymph-nodes

Three weeks after the eye condition developed he noticed soreness at the base of the finger-nails of both hands and patches of skin eruption on the right hand and forearm. These gradually disappeared but traces of the eruption were still evident when he left the hospital. The patient stated that the flesh of the rabbit was normal in appearance and that it was eaten by himself and wife.

This patient was admitted to the Jefferson Hospital with a provisional diagnosis of actinomycosis. On examination the left eye showed a subsiding conjunctivitis. He had a fluctuating swelling about the size of a large marble in the left parotid region and three others of about the same size in the left submaxillary region. The temperature was 99.2° F and the pulse 90. The blood examination revealed hæmoglobin 87 per cent, red blood cells 4,660,000, white blood cells 9800, polymorphonuclears 82 per cent, small mononuclears 16 per cent, transitionals 2 per cent. The Wassermann test was negative, the urine examination revealed nothing of note and the general physical examination showed nothing of importance. The spleen was not palpable. There was no general adenopathy.

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C J Bucher, bacteriologist at the Jefferson Hospital saw the patient in consultation and on learning the history, at once suspected tularemia. On January 11 one of the fluctuating swellings was aspirated and yellow, purulent fluid obtained which on smears showed no actinomycotic fungi, but many pus cells. Doctor Bucher obtained a dead culture of the bacterium tularense from Doctor Francis at the Hygienic Laboratory, Washington, D C on January 13 and made an agglutination test which was positive. The patient's serum agglutinated bacterium tularense in dilution ranging from one in twenty to one in one hundred and sixty. The agglutination was complete in all tubes. On January 15, the broken down glands in the left parotid and submaxillary regions were incised and drained. There was very little discharge after incision and when the patient left the hospital, January 28, the wounds were practically healed.

A few days after admission to the hospital the patient's temperature and pulse returned to normal and remained normal until discharge.

CASE II—B J, female, wife of preceding patient, aged forty-five was treated in the Surgical Dispensary. She had had an infection of the left ring finger which was healed when she came under observation. She gave a history of having developed a swelling of the left ring finger at the tip, forty-eight hours after her husband developed the infection of his eye. The finger at first was swollen, reddened and slightly painful. She shortly developed a fever which ranged between 100° F and 102° F for twelve or fourteen days. She had no chill. She felt weak and ill generally. Eight days after the onset she consulted a physician who made a diagnosis of "Bone-Felon" and lanced the finger. No pus was obtained. Three days later the finger was again lanced without obtaining pus. Two weeks later the left shoulder became sore and painful on movement. At about the same time the infection of the finger developed she noticed a lump about the size of a small marble to the inner side and above the left elbow. Although she had no abrasion on her finger she thought that she had developed the infection while attending to her husband's eye. The finger was never very painful. The swollen area did not have a black centre and did not ulcerate. On examination she had a healed scar at the end of the left ring finger such as one might see following incision for "bone-felon". There was an enlarged and slightly tender epicondylar lymph-node on the same side. Her temperature was normal. X-ray examination of the finger negative. Her blood serum agglutinated the bacterium tularense. She remained under observation until her husband was discharged from the hospital. The enlarged gland was diminishing in size and was no longer tender.

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TREATMENT OF ACUTE TRAUMATIC CRANIOCEREBRAL INJURIES^{*}

By AARON SCOTT MACLAIRE, M D
OF NEW YORK, N Y

ADJUNCT PROFESSOR IN NEUROSURGERY AT THE NEW YORK POLYCLINIC HOSPITAL AND POST-GRADUATE MEDICAL SCHOOL

THE outline of the proper treatment for acute traumatic craniocerebral injuries has not only always served as a general interesting topic for keen and lively discussion amongst surgeons, but also has more recently assumed a more important place in the life of the laity from the standpoint of industrial insurance. Very many of our present cases are found in workers covered by state compensation laws, and the question of the ultimate return to economic and emotional normality is a consideration of great importance not alone to the patient and his family but also to the insurance companies and the state. One can readily comprehend what losses are sustained each year by the families of the improperly treated injured and what additional burden is placed upon the state, social and charitable organizations. In view of these facts, the importance of the proper treatment of this type of injured becomes more immediate and momentous.

Surgeons have more or less always been considered by their medical brethren as the radical group of the profession. Our measures have appeared too drastic to the more conservative and watchful waiting physician. As a result of this criticism the surgeon has gone to the opposite extreme, and has become ultra conservative in too many instances. This, however, should be said for those intending to treat these cases, to be rationally capable of rendering these patients the best possible aid, the surgeon must acquaint himself competently with neurological principles. It is also helpful to remember this axiom that it is best to err on the side of radicalism and return a normal individual than to submit an injured to a permanent damage through the channels of conservatism. Radical treatment in competent hands at least obviates the danger of uncorrective, everlasting and irreparable trauma.

The question of saving life is not the all essential one in the treatment of head injuries, for what benefit is it to the individual if his life is spared if he has not been returned to economic normality? Or if he has been left so emotionally unstable as to require institutional care? The treatment of these cases should be directed towards the return of the pre-injured individual.

In this paper I shall confine the discussion to the treatment of the more common and immediate complications found in the acute traumatic craniocerebral injuries as they enter the hospital.

Fractures of the Skull—Skull fractures are grouped into depressed fractures, linear fractures of the vault and fractures of the base. They may be free from or associated with the common, primary intracranial lesions, such

^{*} Read before the Lackawanna County Medical Society, March 30, 1926

as hemorrhage, cerebral œdema, cerebral contusion and laceration. It is very important to bear in mind that the fracture in itself, except certain types of depressed fractures, is of little consequence in the ultimate outcome of the patient. It does convey to the examiner the force of the blow exerted upon that skull necessary to have produced a separation in the continuity of bone. Formerly, the mere diagnosis of fractured skull spelled the gravest prognosis not alone to the laity but also to the doctor. If the patient survived, it was sometimes considered a miraculous accomplishment on the part of the physician, but more often as the result of an Almighty Miracle. Even at this present time, there are some men who erroneously lay great emphasis upon the presence of the fracture *per se*, depressed fractures being excluded from our consideration here. Juries will render verdicts with huge awards merely for X-ray evidences of linear fractured skulls. This is absolutely incorrect for the main issue in these cases has been overlooked, namely, the complications and the end results.

It is difficult to get these people to comprehend the mechanism of self decompression and to realize how fortunate a person really is with a linear fracture of the skull, whether of the vault or of the base, if a severe head injury is sustained. The force exerted against a skull sufficient to produce a linear fracture must of necessity be transmitted to the intracranial contents. It is true, on the other hand, that there is a water cushion or jacket of cerebrospinal fluid protecting the brain from such accidents but in these cases where fractures are had, that protection is insufficient.

Depressed fractures, on the other hand, are at times of great importance in themselves. The skull in the adult consists of two tables with an intermediate diploe. If a fracture of the outer table alone has been produced without any associated intracranial pathology, the measures instituted are merely expectant and not operative. If the depression involves both tables regardless whether other cerebral lesions are present or not, that depression of bone must either be elevated or removed. Whether only the depression is operated upon alone or whether other procedures must be instituted before that can be safely accomplished, depends upon the presence or absence of associated conditions. If cerebral œdema is present, a preliminary subtemporal decompression of the type advocated by Cushing¹ with the straight incision must first be performed before the depressed area can be elevated or removed with perfect safety. Unless this safeguarding procedure of cranial drainage by means of the subtemporal decompression is employed, there is very great danger of cerebral herniation through the area of the elevated or removed depressed site with ultimate and permanent cerebral damage. If increased intracranial pressure is absent then the depression is alone treated surgically.

If intracranial hemorrhage is present along with the depressed fracture and there is no evidence of increased intracranial pressure, the hemorrhage can be drained by repeated lumbar punctures² and the depression is treated surgically, but if there is no tendency for the hemorrhage to be drained in this manner within four or five days, it is wiser to decompress the individual sub-

temporally and drain the extravasation by the more effective cranial route and to treat the depression next, otherwise a certain amount of chronic cerebral œdema with emotional and mental instability³ may result from the interference with the excretion of the cerebro-spinal fluid. This fluid is absorbed by the supracortical veins, venous sinuses and Pacchionian bodies, but 80 per cent of it is through the supracortical veins, and if the hemorrhage in its absorption leaves behind a layer of white film of organization residue coating these venous stomata of exit, it is readily seen how a stagnation can be produced and a chronically increased intracranial pressure exerted upon the brain. Both operations can be performed at one sitting and are easily done under local anæsthesia. One word in regards to the decompression operation itself. A decompression is not a decompression unless the dura is incised widely and left unsutured, in fact, it is impossible to resuture the dura with perfect approximation in these cases.

Linear fractures of the vault without displacement of the fragments is *per se* in all cases an adjunct in the treatment of acute traumatic craniocerebral injuries. It is a method whereby nature attempts to decompress itself and permit the increased amount of œdema to escape into the tissues for absorption. In these cases where the clinical signs do not manifest any indication of cerebral compression, the treatment is symptomatic and expectant. If the line of fracture should pass through the facial canal, peripheral facial paralysis may occur as a result either of direct traumatic severance of the nerve or of œdema of the nerve in the canal. The auditory nerve coursing the same aqueduct may also be involved.

Where the line of separation caused by the fracture is insufficient to overcome the increasing cerebral compression by the rapidly forming œdema, several justifiable methods of treatment may be utilized to reduce the swollen brain. These will best be discussed under the heading of the treatment of cerebral œdema.

Similarly, intracranial hemorrhage, when associated with linear fractures, will be treated in a future paragraph.

Fractures of the base of the skull are considered in the same light as linear fractures, there are no measures directed primarily to the fracture itself. The treatment is that of its complications which will be fully outlined further on in the paper. There are, however, these added features in basilar fractures. With fractures of the anterior fossa a cerebrospinal rhinorrhœa may be present if the line of fracture extends into the cribriform plate. This is a very effective method of decompression not alone in cases of craniocerebral injuries but also in some cases of cerebral neoplasm⁴. When the fracture is in the middle fossa, the decompressive exit is through the external auditory canal, which at times may be sufficient to ward off any complicating dangers. Posterior fossa fractures are very often apt to produce a cerebral œdema which is not only rapid in its formation but also drastic in its effect upon the medulla in that infratentorial compression hastily passes

through the stages of medullary compression into that of œdema where surgical treatment is contraindicated

Concussion —Concussion is a condition which we freely discuss but concerning which we know very little pathologically. Patients do not die in this stage, and to produce the duplication of this condition experimentally with any degree of satisfaction is very difficult. We content ourselves by employing the loose but descriptive phrase, "shaking up of the brain". If we are willing to admit that concussion is a commotion of the brain, then the experimental findings of Sven Ingvar⁵ of Sweden may aid us in better comprehending what very likely happens in these brains. This author centrifuged the heads of mice at a speed of 3000 revolutions per minute and he was able to demonstrate some surprising results. The conclusions of his histological studies were as follows

"That the nucleolus of the ganglion cell is the part of the cell most easily moved within that cell and that it is always thrown to the distal end of the nucleus which proves that the nucleus is a vesicle, the contents of which have a low viscosity"

"That the next most conspicuous change after centrifugation consists in an accumulation of the chromatophil substances at the distal end of the cell, and proves that these bodies must exist in a fluid condition in the living cell"

"That the canalicular apparatus is squeezed out of its position in the cell by centrifugation, but maintains its normal morphological character, this demonstrates that the contents of this apparatus do not mix with the chromatophil substances and that they probably have a high viscosity"

"The whole set of neurofibrils loosens as a unit from the cell membrane and when centrifugation has been sufficiently strong, occupies the centre of the cell and encloses the nucleus"

In view of the findings of Ingvar, I am inclined to feel that concussion, although not a demonstrable pathological entity in the human, produces intracellular changes of some degree which is sufficient to cause usually a temporary alteration of some form in the life mechanism of the nerve cell although permanent sequelæ have been known to follow spinal cord concussion⁶. This explanation perhaps would account for the hitherto unexplainable signs and symptoms in some patients. An illustration of what is implied can be found in this case

R. M. (N. Y. P. H. 2094), a negro, thirty-one years of age, was admitted to the hospital, September 28, 1923 at 10 30 A. M. He was brought to the hospital in a taxicab after having been struck on the right frontoparietal region with an iron cover of a waste press machine that weighed between forty and fifty pounds. He was unconscious for about five minutes. There was no bleeding from the nose, ears or throat. He was still dizzy upon his admission although he could walk. Vomiting, convulsions or muscular twitchings were absent. His pulse was 60 and the temperature 97.2° F by mouth. A soft fluctuant mass was present over the right frontoparietal region, the site of the injury. He was put to bed and treated for shock.

The examination was done at 8 15 P. M. that evening. The patient was lying comfortably in bed, not in shock but in very good condition. Evidences of contusions and

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lacerations were everywhere absent. No ecchymosis was noted in the mastoid, supra-orbital or external angular process sites. No fractures were palpable anywhere. The swelling over the right frontoparietal region present on admission was absent at this examination, the scalp over that site was freely movable.

The left biceps and patella reflexes were slightly more active than the right ones, the latter being normal in response. The triceps and achilles reflexes were equal and active on both sides. The left epigastric and abdominal reflexes were less active than the corresponding right ones, although the left ones were not diminished. The cremasterics were normal. Ankle clonus, Babinski, Chaddock, Oppenheim, Gordon and Schaeffer were absent. The optic discs were in the main negative, although the nasal margin of the right disc was not as distinct as its corresponding fellow. Blurring of the disc margins were absent. The fundal veins were somewhat enlarged out of proportion to the size of the arteries on both sides. The right pupil was dilated to about 4 mm, the left to about $2\frac{1}{2}$ mm. Reaction to light, in accommodation and consensual reflexes were all normal. Extraocular movements were normal. Nystagmus was absent. The motor and sensory trigeminal distributions together with the corneal reflexes were also normal. The facials were intact. The Rinne and Weber tests were normal, hearing intact, the drums negative but the external auditory canals were full of cerumen. The palate moved normally, the uvula also and the pharyngeal reflex was active. The tongue protruded in the centre, tremor was absent and movements normal. The sensory examination of pain, touch and muscle tendon sense was normal. On the following day the lumbar puncture was performed and the fluid was clear under a pressure of 6 mm Hg, indicating the absence of increased intracranial pressure. The blood pressure varied from 104 to 122 systolic, while the diastolic remained at 40. The pulse ranged during the first six days between 48 and 60. Most of the time the pulse was between 50 and 60. Between the seventh and the tenth days the pulse was between 60 and 72, being 72 only on the last day of his hospital confinement and the day upon which he demanded his release. The temperature most of the time was subnormal and the respirations remained at the level of 20 during the entire hospital period. The X-ray was negative for fracture and the spinal fluid Wassermann was negative.

Here is a case of cerebral concussion with a pulse between 48 and 60 most of the time, together with subnormal temperature during that entire period and the patient not in shock. These findings do not coincide with any phase of intracranial compression, yet the pulse remained low. The patient may normally have had a bradycardia, but the fact that his pulse did return to a more normal level during the second week would tend to rule out such a possibility. Some alteration in the cell must have occurred to give that clinical picture. The explanation perhaps lies in the anatomical or biochemical change in the cell structure, a change which is sufficient to account for the temporary existence of symptoms and signs and yet of such a character as not to be severe enough to produce the death of individual. Ingvar's theory is plausible and may be the pathological solution of the concussion problem.

The treatment of concussion of the brain is entirely expectant with the patient in bed. The symptoms of headache, dizziness, insomnia, weakness, the various phobias, loss of self control and lack of ambition persist from six weeks to three months. Psychotherapy together with mild sedatives will usually return the individual to normal health provided the legal element is satisfactorily adjusted or permanently eradicated.

Cerebral Oedema—Acute traumatic cerebral oedema in all probability is the effect of a sudden mechanical irritation of the choroid plexus⁷ with a

resultant hypersecretion of the cerebrospinal fluid in the presence of diminished absorption as a result of cerebral venous congestion. In the presence of a linear fracture of the vault or the base where an escape of the excess fluid is afforded, the cerebral compression may either be entirely offset by nature's method of self decompression or delayed by those same means. If the cerebral oedema continues to manifest itself clinically, and I include the accurate estimation of the intracranial pressure by means of the spinal mercurial manometer⁸ as one of the clinical signs at our command at the present time, one or more of the several methods of dealing with this condition may be instituted.

Since Weed and McKibben⁹ have reported their observations upon hypertonic salt solutions, the neurosurgeon has often had satisfactory recourse to the method described in their enlightening work. Yet, do not be misled into believing that hypertonic solutions are a panacea for all such cases, and that the results are 100 per cent perfect or permanent. It is a valuable addition to our armamentarium, yet not the final answer to all our traumatic head problems. Salt has proved its value not only in a certain group of acute traumatic cranio-cerebral injury cases but also in dehydrating tumor brains¹⁰ preparative to and during cranial operations and in that respect making it possible to open the dura safely without risking the complication of forcing the brain out through the flap window and also assuring the surgeon of safely approximating the bone flap without forcing or jamming the brain back into the skull.

In the milder types of cerebral oedema various dehydrating agents may be used either by intravenous instillation or by high rectal enema. The more common drugs in use for this purpose have their own advocates. There is an element of risk in the use of some of them, although small, yet sufficient to warrant us to be cognizant of that fact, and the possibility of its undesirable effect in certain cases would perhaps lead us to employ other measures which under ordinary circumstances we would not.

Sodium chloride in 15 to 30 per cent solution, given in 50 to 100 c.c. doses intravenously, is a most powerful dehydrant at our command. Given into the alimentary canal, it has been found to be less potent, but it was observed that the circulatory and respiratory disturbances noted frequently in the intravenous administration were avoided^{11, 12}. There are several contraindications to the use of this salt. Chronic cardiac, respiratory and renal conditions immediately bar its use. In addition, it is toxic¹³ and dialyzable¹⁴ and as such is capable of becoming absorbed into the cell and forming an integral part of the structure. Once sodium chloride becomes an inherent part of the cellular protoplasm, the biochemical change is permanent and secondary intracellular brain oedema which follows is also permanent and non-reducible.

Personally, I rarely use intravenous hypertonic sodium chloride except when in a particular emergent predicament, as will be shortly narrated in an illustrative case, and then never repeat it because of the danger of secondary intracellular cerebral oedema.

ACUTE TRAUMATIC CRANIOCEREBRAL INJURIES

D A, N Y P H 6697, was admitted August 22, 1924 and discharged September 5, 1924. The patient was admitted with a pulse of 80 and a temperature of 96.4°F . He was pale, the skin was cold and clammy, perspiring freely and in evident shock. This man, twenty years of age, was struck on the head with a blunt instrument while walking down the main thoroughfare in New York City. He fell to the street and was unconscious for a short time and soon began to bleed from the nose. He also coughed up some blood as well as vomited several times. Mentally he was groggy and disoriented. He was treated for shock.

On the following morning the neurological examination revealed these findings. Both biceps and the right triceps reflexes were unelicited, the left triceps barely responded. The patellas and achilles reflexes were equally depressed. Babinski, Gordon, Chaddock and Schaeffer were absent on both sides, a spurious Oppenheim was occasionally present on the left side. The epigastric and abdominal reflexes were likewise absent. The cremasterics were active on both sides. Sensation to pain and touch were normal. The nasal margin of the left optic disc was slightly blurred, the right disc was negative. The fundal veins were somewhat engorged in both eyes. The pupils were equal in size in mid-dilatation, reacted to light and in accommodation, nystagmus was absent, extra-ocular movements were normal. There was a right lower facial weakness. The corneal reflexes were active and the sensory portion of the trigeminal nerve intact. The motor divisions, although intact, caused pain when he brought his jaws firmly together. The uvula pointed slightly to the left but moved normally on phonation. The pharyngeal reflex was absent. The tongue deviated slightly to the left, the movements were slow. The mastoid or external angular process did not disclose any ecchymotic discolorations. There were no evidences of active bleeding from the external orifices with the exception of occasional bloody expectoration. His head and jaws were tender wherever palpated, particularly the left temporoparietal part of the skull. A laceration of the scalp over the occipital area was present. The intradural pressure was 14 mm Hg and the fluid was bloody, 25 c c were removed and the pressure dropped to 4 mm Hg.

He was treated by repeated lumbar punctures daily with the reduction of the intracranial pressure to normal each day. The intrathecal pressure ranged as high as 24 mm Hg and 30 c c was the most withdrawn at any one sitting. In addition, he was placed on two ounces of concentrated magnesium sulphate by mouth a day, and the fluid intake was restricted to 1000 c c per twenty-four hours. On the sixth day the pulse dropped to 60 and the temperature began to rise to 104°F , the blood pressure was 150/40 and the intraspinal pressure 24 mm Hg. The cerebrospinal fluid was clearing as far as the hemorrhage was concerned but the reduction in the cerebral oedema was not progressing favorably. The patient was becoming noisy and was definitely more drowsy. The pulse also started to rise during the past hour and had reached 88 per minute. It was felt that a subtemporal decompression should have been performed earlier and that the patient had broken through his compensation and was progressing towards medullary oedema. It was decided to attempt to head off this complication by a subtemporal decompression when it was learned that operative permission had not been signed. All endeavors to communicate with his relatives during the evening proved futile and under those circumstances operation had to be postponed. It was felt then that an intravenous injection of 15 per cent solution of sodium chloride would tide the condition over until the next morning when permission for operation could be obtained. By the following morning the intradural pressure was reduced to 18 mm Hg, the blood pressure dropped to 124/44, the temperature was 101.2°F , and the pulse 68. The examination of the urine for evidences of acidosis were all negative. The blood examination on this day revealed 5,360,000 red blood cells, 12,000 white blood cells, hæmoglobin 88 (Dare), color index 8+, differential count, polymorphonuclears 77 per cent, lymphocytes 23 per cent. The water intake was increased to 1200 c c a day, a large part of which consisted of orange juice. Magnesium sulphate was reduced to one ounce a day while the lumbar drainage was increased to two taps daily. The temperature gradually approached normal,

the pulse ranged between 60 and 70, the respirations to 20 and the spinal pressure at the end of the twelfth day was 10 mm Hg. The patient was discharged two days later without any complaints. He had been out of bed for three days previous to his discharge and all dehydration treatment and spinal drainage had also been discontinued at that same time, his fluids were unrestricted from that date. The X-rays never demonstrated any signs of fracture and the spinal Wassermanns were negative on two occasions.

Here is an example of what hypertonic salt solution will do in an emergency, although now I do not feel that the patient was developing a medullary oedema. The similarity of the clinical picture that I depicted to acidosis is very suspicious in spite of the negative urinary findings. I am inclined to believe that acidosis must exist for quite some time before the urine will disclose acetone and diacetic acid. We did fail to do an examination of the carbon dioxide combining power of the blood. That would have solved the question of acidosis. I have always felt the rise in temperature and the rising pulse in this case was due to a beginning acidosis. The power of hypertonic salt intravenously as a dehydrant was very well demonstrated.

Magnesium sulphate is perhaps the best of all the dehydrating agents, in that it is absolutely free from all possible dangers. It is non-dialyzable¹⁴ and, therefore, non-absorbable, and when given either by mouth or by rectum will be productive of results. It is best employed in the form of rectal enema every four hours. The formula I employ is 1½ ounces of the pure crystals of magnesium sulphate dissolved in four ounces of water and administered by high rectal enema every four hours. The fluid is allowed to flow slowly into the gut so that it will be retained for some time. Where expulsion of the salt occurs in an irritable bowel, it must be given by mouth. In many mild cases of cerebral oedema, this therapy will produce the much desired effect. Dowman¹⁵ has reported good results from its use and is very enthusiastic.

Another intravenous agent at our disposal and one that is rapidly gaining more favor than sodium chloride for intravenous use is glucose solution in 50 to 100 per cent strength. This can be administered rapidly in 100 per cent concentration without any ill effects¹⁶. The pressure begins to fall three minutes after the completion of the administration of the drug, and continues for 30 or 40 minutes when it reaches its lowest point and remains there for two hours¹⁶.

Where dehydrating fluids fail to show a gradual and persistent lowering in the cerebrospinal fluid pressure and the signs of cerebral compression progressively grow worse, repeated lumbar punctures with drainage can be instituted in addition. Sachs¹⁷ vigorously opposes the use of spinal punctures in these cases because of its danger, and states that men conceal their fatalities from this procedure. I have had a death following lumbar puncture in a case of delirium tremens with alcoholic peripheral neuritis. I have also seen many deaths following subtemporal decompression for advanced cerebral oedema in the presence of hemorrhage. Does that therefore militate against or condemn the procedure? Should an occasional death deter us from repeating a measure that has been efficient and beneficial in very many instances?² If that were the state of affairs in surgery, then operations for brain tumor

should be contraindicated because of the relatively high mortality. If surgery is to be condemned for an occasional death, there would not be any further need for any kind of surgery.

To obviate some possible deaths or to perhaps reduce the mortality that occurs from lumbar puncture, the patient can be placed in the Trendelenburg position as I have suggested elsewhere¹⁸ for another situation.

If the cerebral oedema shows no indication of being checked by the above-mentioned measures within four or five days, it is better judgment to perform a subtemporal decompression with cranial drainage in order to give the individual the best possible opportunity for the restoration of normal physical and cerebral functions.

In cases of fractures of the base of the skull in the posterior fossa, the oedema, if present, is very apt to be not only progressive but diastolic in its effects upon the medulla. Where cerebellar signs are present with medullary compression the suboccipital decompression must be performed in preference to the subtemporal decompression. When the stage of medullary oedema has already been reached, there is very little available in the line of therapy to overcome that handicap. Rand and Nielsen¹⁹ have performed cisterna magna punctures in two moribund cases without any success. On theoretical grounds, I feel that the too sudden escape or the too great removal of the amount of fluid from the cisterna cerebellomedullaris can be safely avoided and combated as well as better gaged if the patient should be placed in the Trendelenburg position during the entire procedure and to be allowed to remain so for several hours after. Should this technic prove favorable, it will grant the injured just one more chance to adjust his medullary compensatory mechanism and put him in better position for operation. Where medullary oedema persists in spite of all treatments, operation is absolutely contraindicated.

Cerebral Oedema with Intracranial Hemorrhage—The association of intracranial hemorrhage of fair size with cerebral oedema presents to us a problem which must be diligently handled in order that a chronic condition may not persist as a result of dilatory measures.

Repeated lumbar punctures with drainage have proved their merit as a means of draining subdural hemorrhages. Repeated spinal drainage has also proved efficacious in relieving mild degrees of cerebral oedema. Where the combined condition exists, repeated spinal punctures should be given a trial for a few days. Dehydrating fluids should not be employed here for fear of concentrating the extravasation by the removal of the fluid portion of the blood and thereby facilitate the formation of a blood clot, the absorption of which will leave behind an organized fibrous residue coating the supracortical veins which situation tends to create a chronic wet brain, which corresponds to the hydrocephalus non-absorptus,²⁰ by interfering with the natural process of excretion of the cerebrospinal fluid. When lumbar drainage fails to satisfactorily relieve both conditions, subtemporal decompression with cranial drainage is the procedure of choice. The following case is extremely interesting in that the treatment advised above in cases of combined hemorrhage with

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cerebral α edema resulted from being able to see the patient's brain at operation after two weeks' trial with dehydrating fluids and repeated lumbar punctures. This is an instance where I endeavored to be conservative and attempted to institute non-operative measures to restore this patient to well being but after dehydrating him for two weeks and performing twenty-two lumbar punctures within that time, I found that his mental condition was such as to require operation. His cerebral α edema persisted in spite of all non-operative measures. I then operated and the patient immediately reacted to the cranial drainage and has so improved that it is almost impossible to retain him in the hospital, he wants to go home.

J. G., a laborer, fell from a scaffold, a distance of 30 or 40 feet. He was found unconscious and was admitted to the hospital on February 19, 1926 (N. Y. P. H. 15,691). On admission his temperature was 97.4°F (axillary temperature), pulse 80, respirations 25. He was treated for shock. (Admission 11 A. M.)

At 4 P. M. I examined him and these were the findings then. Our patient was a strong, well built man, lying in bed, somewhat restless and fairly cooperative. There was a scalp wound about two inches long in the left posterior parietal region, overlying the midline. There was slight bleeding from the scalp wound on pressure and the collection of blood in the tissues was insufficient to be called a hematoma. It was difficult to see the fundus of the left eye as the patient did not hold the eye fixed long enough for the disc to be located. The right eye was artificial but a perfect duplication of the other. The left pupil reacted to light, nystagmus was absent, all extraocular movements were normal. Ptosis of the lids was not present. Ocular movements of the glass eye were very good, no palsies were noted. The left pupil was about 3 mm in size. A slight left lower facial paresis was present. Bleeding from the ears, nose or throat was absent. Ecchymosis under the left eye was beginning to accumulate. The tongue was cyanotic and was not protruded very far out of the mouth. The biceps and triceps were equal and normal in response. The patellas were unelicited, the achilles both active, the right one a little more so than the left. Definite right-sided Babinski was present without any of the modifications. The left presented fanning though no absolute Babinski. The sensory examination was not reliable. The cremasteric reflexes were normally present but the abdominals and epigastrics were absent. The lumbar puncture revealed bloody cerebrospinal fluid, the color of port wine, under a pressure of 20 mm. Hg. After the removal of 46 c.c. of this fluid the pressure dropped to 9 mm. Hg. I decided to attempt to try conservative non-operative treatment upon this case. The results proved to be more than interesting, they were very instructive.

For two weeks this man was dehydrated with concentrated magnesium sulphate every four hours per rectum together with two spinal drainage taps daily. The pressure was reduced each time to normal. At the end of two weeks of this careful observatory treatment the intracranial pressure still remained unreduced, the patient was noisy, irrational and at times mentally retarded and dull, his pulse 60 with a poor prognosis for future normality if his condition was not relieved. Subtemporal decompression was decided upon and on March 6, 1926 I operated. The permanent cranial opening made was fully $2 \times 2\frac{1}{2}$ inches in diameter. On the second day post-operative he began to show signs of mental improvement which has progressively continued up to the present and the patient is now ready for discharge. One word in reference to the operative findings. When the brain was exposed it was found to be pale yellow, very wet and α edematous, and the supracortical veins and cerebral sulci were covered by white organized tissue that is found after the absorption of a hemorrhage in this site. (This case will be reported in detail in a future publication.) The operative area is at present slightly depressed and pulsating normally indicating the absence of an increased intracranial pressure and a return to normal intracranial conditions.

Intracranial Hemorrhage — Hemorrhages in this locality are either extradural, subdural or intracerebral. When it is felt that the middle meningeal artery has been lacerated and continues to bleed, operation is absolutely compulsory to control this hemorrhage whether increased intracranial pressure exists or not. Cases of extradural hemorrhage also require operation as spinal drainage by means of repeated lumbar puncture will not influence the extravasation in this site. Subdural hemorrhages of mild degree lend themselves favorably for spinal drainage by means of repeated lumbar punctures every six to twenty-four hours, depending upon the severity of the hemorrhage. Where the bleeding is not progressive and cerebral compression does not supervene, repeated lumbar puncture drainage gives satisfactory results. If, on the other hand, the hemorrhage is progressive or if the percentage composition of the blood in the cerebrospinal fluid does not indicate a daily decrease by means of repeated lumbar punctures, cranial exploration with drainage is essential in order to avoid the effects of chronic subdural hæmatomas.²¹ Intracerebral hemorrhages in themselves require no special attention, the destruction of cerebral tissue has already occurred and the damage is irreparable and permanent. So-called idiopathic epilepsy of the adult very often is the end result of a long forgotten or undiagnosed intracranial, more often petechial intracerebral, hemorrhage.

Cerebral Contusion and Laceration — Contusions of the brain unassociated with any complications require no special treatment in themselves. Where laceration of brain tissue has occurred, there is very apt to be varying amounts of hemorrhagic clots in the site of the cerebral destruction. Operation in these cases is performed only with the intention of cleansing the field and draining whatever œdema or oozing that may occur. The latter type of case is usually associated with intracranial hemorrhage either intracerebral or subdural. The repair of the damaged brain must be left solely to nature. The resultant scar formed in the process of healing may be the cause of future epilepsy, and that is not within the scope of our power to prevent.

SUMMARY

Whether a fracture, aside from depressed fracture, is present or not is not of material consideration in the treatment of cerebral œdema with or without intracranial hemorrhage or any other cerebral lesion. The presence of a linear fracture, as has often been pointed out, is of great benefit to the individual suffering from a severe head injury. It is a natural method of decompression and endeavors to prevent the development of cerebral compression.

The relative value of the dehydrating agents must now be given some attention. Sodium chloride in 15 to 30 per cent solution intravenously with its attendant cardiac, respiratory, renal and dialyzable dangers can be relegated to the realm of drugs which have already served their purpose in the progress of scientific advance. It need never be employed in view of the other safer measures at hand.

Glucose in 50 to 100 per cent solution given intravenously in quantities

up to 100 c c within a few minutes has not caused any ill effects in the hands of its experimenter ¹⁹ It does not produce any of the disturbances that renders sodium chloride undesirable, yet it possesses the same fault that any intravenous solution has, in that it creates an initial rise in the intracranial pressure before lowering it It must, therefore, be used cautiously in those cases of medullary compression where the margin of safety is comparatively small in view of further increase in the intracranial pressure It is better surgical judgment, in my opinion, to operate upon these cases in this stage than to attempt to dehydrate them, for the additional rise produced by the intravenous solution may cause a medullary oedema if the compression is progressive Surgical interference at this time is absolutely contraindicated Glucose should be used in cases of cerebral oedema in preference to the other intravenous solutions if that route of treatment is desired One must be certain that pancreatic diabetes is not present in the individual who is to receive the solution, as diabetic coma may develop from such an additional amount of sugar given into the blood stream

Magnesium sulphate in the concentrated solution advocated is the ideal of all the dehydrating fluids at our command It can be administered either by rectum or by mouth with perfect safety and freedom from any of the above mentioned dangers Besides, it does not have the disadvantageous feature of producing the initial rise in the intracranial pressure that all the intravenous solutions possess It is the ideal of all the dehydrating agents and is one of choice Dowman ²² even employs it intravenously in 10 per cent sterile solution, giving 10 c c in the adult every four hours for six to eight doses, and claiming very laudable results He has not met with any toxic or untoward effects I have no personal experience with this method Naffziger ²³ has described a condition in which the collection of fluids was found to be subdural, these cases respond well to salt dehydration or to operation There is no way at present to diagnose this condition prior to operation

In cases of non-progressive hemorrhage associated with or without linear fractures of the vault or base of the skull, lumbar punctures with drainage should be given a trial for a few days if the condition of the patient does not warrant an immediate operation If the quantitative percentage of the blood in the cerebrospinal fluid does not diminish at the end of four or five days of repeated lumbar drainage, subtemporal decompression should be performed for the purpose of restoring a normal individual without future emotional instability In cerebral oedema either with or without hemorrhage, lumbar puncture may also be used with the same indications as described for hemorrhage In uncomplicated cerebral oedema lumbar puncture may be added to the dehydrating salts to facilitate and hasten the reduction in the increased intracranial pressure

The subtemporal decompression still retains its undisputed value as a means of not only saving life and reducing cerebral oedema but also of restoring the injured to future normality The operation is indicated where the salt dehydration and spinal drainage fail to produce the desired results and in

cases of progressive hemorrhage due either to the rupture of cortical vessels or the middle meningeal artery, or in cases of extradural hemorrhage and subdural hæmatoma. A bilateral subtemporal decompression must be performed in those cases where the brain fails to pulsate after one side has been operated upon and where the brain still continues to bulge in spite of the relief of pressure on one side.

Suboccipital decompressions are indicated particularly in those instances where fractures of the posterior fossa exist with rapid forming medullary compression associated with cerebellar signs. Where other non-operative procedures fail, decompression is indicated. There are just two contraindications to operation and they are at both extremes, namely, shock and medullary œdema.

A helpful rule to bear in mind, when in doubt as to the proper procedure to employ with the patient out of shock and not in medullary œdema, is to perform a subtemporal decompression for the future welfare of the patient. What may seem to be radical advice is in competent hands a measure far less dangerous to the future well being of the patient than dilatory procedures which may render him unstable and emotionally unqualified to combat the daily struggles of everyday life.

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ASYMMETRY OF THE MANDIBLE FROM UNILATERAL HYPERTROPHY*

By ADAM GRUCA, M D

ASSISTANT AT THE CLINIC

AND

EMIL MEISELS, M D

RONTGENOLOGIST

OF LWÓW, POLAND

FROM THE SURGICAL CLINIC OF THE JOHN CASIMIR UNIVERSITY, LWÓW, POLAND
DIRECTOR, PROF DR HILARY SCHRAMM

THE following case of unilateral hypertrophy of the mandible merits recording on account of the rarity of the condition and of certain circumstances connected with the diagnosis

F B, a mechanic, aged twenty-four. No congenital deformities in his family. At the age of ten years he suffered from an inflammatory process of his right ear, accompanied by pain and discharge from the ear. The latter stopped after a year, but there remained a partial impairment of hearing. When he was thirteen years old his family became aware of the fact that his under lip and chin deviated slightly to the left and his teeth did not exactly correspond. He then underwent an orthodontic treatment by a dentist, who tried to enlarge correspondingly his upper alveolar process(?) The treatment, which continued till 1918, was, however, unsuccessful, as the deformity grew gradually worse. With its progress, pain, spontaneous and on movement appeared in the region of the right temporo-mandibular joint, radiating along the right half of the mandible. From time to time opening the mouth or closing it after yawning became impossible. Within the last ten years many examinations by internal specialists, dentists, neurologists and surgeons were made. As his hands and feet were found somewhat too large, acromegaly was suggested. The organotherapeutic treatment with hypophysis and thyroid gland extracts has, however, had no influence on the course of the deformation. The last examination in the neurologic clinic of the J C University a week prior to his admission to our clinic was negative. No sella turcica enlargement or destruction was then found.



FIG 1 —Case I before operation

* Read before the Medical Association in Lwów, January 29, 1926

in the X-ray picture Eye ground was also normal Examination of the ears revealed destruction of right drum and a chronic middle ear inflammation of the left Wassermann test in blood and cerebrospinal fluid negative In urine no pathological contents On admission to the clinic the patient asked for operation because of pain and disability as well as because of the facial deformity, which hindered him from getting any employment He said he had decided to commit suicide, if his state could not be improved

Examination on Admission April 21, 1925—A strong, well-developed, not very well-nourished man The face showed on inspection a deformation of very high degree (Figs 1, 7) The chin was drawn considerably toward the left side and forward The lips,



FIG 2—Case I Postero anterior X-ray picture before operation Right half of the mandible considerably hypertrophied and asymmetric Slight asymmetry of right maxilla

the under lip especially, displaced also leftward The left half of the under lip forced nearly one and a half cm in front of the upper lip The left naso-labial sulcus, running more horizontally than the right, was flatter The right cheek fuller and more rounded The middle line of the mandible drawn about two and a half cm to the left, the most eminent point of its curvature being about 3 cm in front of that of the maxilla Also the lower border of the mandible considerably lowered When the mouth was closed the upper right canine corresponded to the first right lower molar The incisors were about one and a half cm in front of the upper incisors The shape of both alveolar arches approximately equal The range of movement of the mandible normal By movement to the

side a noise in the right temporo-mandibular joint was audible to the observer The deformation was less apparent when the mouth was open, but on closing, the middle of the mandible ran an arch to the left

By palpation one found the external surface of the right half of the mandible more rounded outward and downward The ascending ramus longer, the region of right temporo-mandibular joint somewhat tender on pressure, the coronoid process lowered, the mandibular incisura deeper, than normal and easily touchable from the inside of the mouth The right half of the mandible was about 3 cm longer and $\frac{3}{4}$ cm wider than the left

The internal and external soft parts of the face normal and symmetrical The nose was normal There was no obstruction or enlargement of the sinus Also no overgrowth or thickening of the skin or subcutaneous tissues of any part of the body The nervous system showed no signs of abnormality Circulatory, respiratory and abdominal organs normal Feet and hands seemed to be in relation to the stature somewhat too large but otherwise normal

ASYMMETRY OF THE MANDIBLE

The Rontgen-ray examination (Figs 2, 2a and 3) showed the skull large and long. Its vault thickened in the region of the tubera frontalia. The coronaria sutures indistinct, the occipital distinctly visible. The grooves for the meningeal vessels faint, of normal breadth. The bottom of the anterior cranial fossa slant. Cerebral juga here somewhat increased. The middle cranial fossa regularly vaulted. The sella turcica spacious, thumb-shaped, of normal depth. The contours of its bottom smooth and regular. The anterior and posterior clinoid process well developed, smooth, regularly outlined. The posterior fossa somewhat backward vaulted. The face skeleton asymmetrical. The chin drawn to the left. Right half of the mandible considerably enlarged in all directions and curved outward and downward, the middle of the horizontal ramus being displaced about 3 cm to the left and by one and a half cm forward in comparison with the maxilla. Its external and lower borders curved and lowered, forming an uneven arch from the lower right to upper left. Also the medial part of the left half of the mandible to the left canine was hypertrophied. The rest of it was in comparison with the opposite side flattened, smaller and narrower, but apparently normal. Its interior structure was also normal, whereas the right part showed changes in the structure, its spongy bone tissue being of regular network, but with unusually enlarged holes. The canalis of the mandible was distinctly visible, not narrowed. Round the roots of the premolars and molars granulations focus were visible.

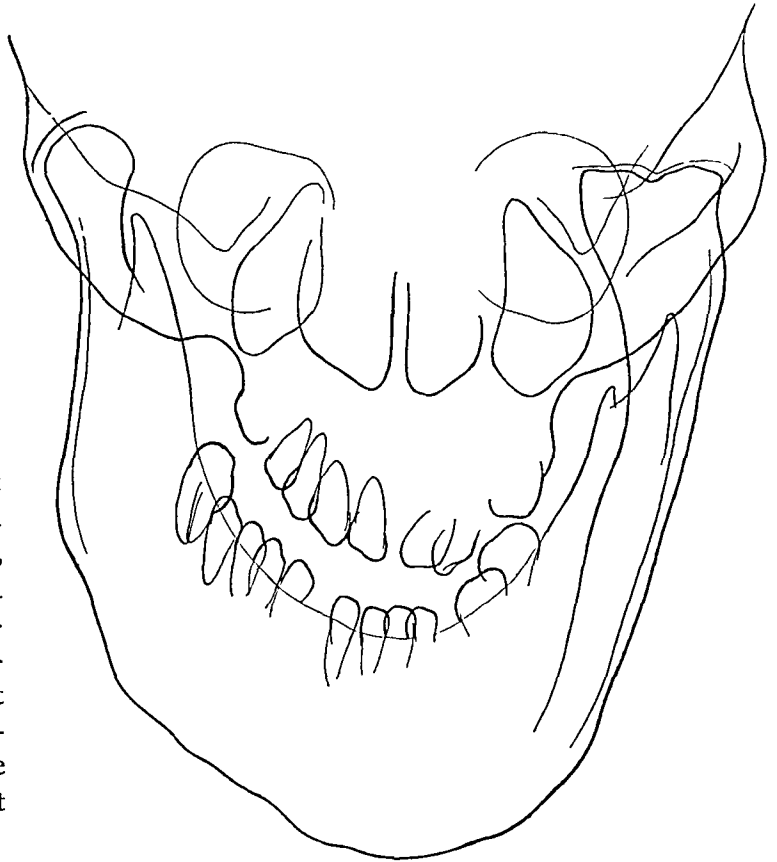


FIG 2a —Case I Outline sketch from Fig 2, inverted

The main changes were found in the right ascending ramus and especially in the condyloid process, the articular head of which, being considerably enlarged and club-shaped, was composed of two unequal parts, separated by a shallow groove. Below the capitulum there was a conic bony process, separated from it by a deep cleft, about one and a half cm long, inclined to the under surface of the zygoma.

The condyloid process well developed, thickened, almost twice as thick and one and a half times as long as that of the opposite side, curved its whole length. Its thicker cortex surrounded dense spongy bone tissue. The coronoid process appeared also hypertrophic, massive. The lingula thorn-shaped. The rest of the vertical ramus also by a finger-breadth longer than that of the left side and bent outward. Right upper alveolar process slightly hypertrophic, inclined downward and bent to the left. Its interior structure normal. The sinus well developed, distinctly margined and of normal air contents. *A diagnosis of overgrowth of the right head and neck of the mandible was made.*

Operation May 7, 1925, by Professor Schramm. Under local novocaine anaesthesia of the third branch of the right trigeminus nerve and imbibition of soft parts round the temporo-mandibular joint, an incision was made along the lower border of the zygoma, two cm in length backward to the auricle, thence downward for two cm in front of the last. The joint was exposed and opened and then the periosteum removed from

the whole circumference of the neck of the condylod process To protect the soft parts two elevators were inserted behind the bone and then the neck was cut with chisel and hammer from behind and below forward and upward, thus shaping the stump like a normal head The head was then grasped firmly with a forceps, turned and pulled out from the joint cavity The intra-articular disk was left in place The mandible was then righted without difficulty of any kind The wound was closed in layers and a plaster bandage applied holding the jaw in its new position

May 8—Right angle of the mouth lowered Impossible to close right eye

May 17—Wound healed by primary intention The patient could open and close his mouth without discomfort to a normal degree The paresis of the lower branch of the

facial nerve improved Though the middle of the mandible was now exactly in the median line, the face was somewhat asymmetric, for half (the right side) of the jaw remained from $\frac{1}{2}$ to $\frac{3}{4}$ cm too low The incisors of the jaws were also still not in contact for the lower molars were too long The patient was given over to the stomatologist (Professor Doctor Cieszynski), who extracted the fifth and sixth upper and filled the lower, thus restoring the normal articulation

July 20—The facial nerve paresis was gone with some effort the patient was able to raise right angle of the mouth and close

right eye The scar of the operation scarcely visible on inspection Right upper canine corresponded to the lower one, but the latter as well as the lower incisors were still slightly in front of the upper The molars were in good opposition

The removed piece of the condylod process was like an inverted pyramid, flattened in antero-posterior direction 4.9 cm in length, 3.3 cm in width in its upper, 1.4 cm in its lower extremity The articular surface enlarged in all directions and uneven showed a sulcus running in sagittal plane, dividing the articular surface in two unequal parts, both covered with cartilage smooth and shiny There were some exostosis at the margins of the cartilage, forming a sort of a collar round the articular surface On the anterior aspect of the mass the cutting surface was visible, reaching the middle of its length Thus the operation resulted in the shortening of the ascending branch of the mandible by about two and a half cm (Fig 4)

A Rontgen-ray photograph of the removed bone revealed that the inner part of the mass was composed of two exostoses, one at the head, the other at the neck of the condylod process, separated from each other by a deep cleft The bone tissue appeared normal without any structural change

The microscopical examination of a section taken from the articular end of the mass showed spongy bone normal in structure Bony cells of typical arrangement Bone-marrow composed of fat tissue poor in cells The articular cartilage, hyaline, showed cells in proliferation The latter arranged in columns parallel to the axis of the bone

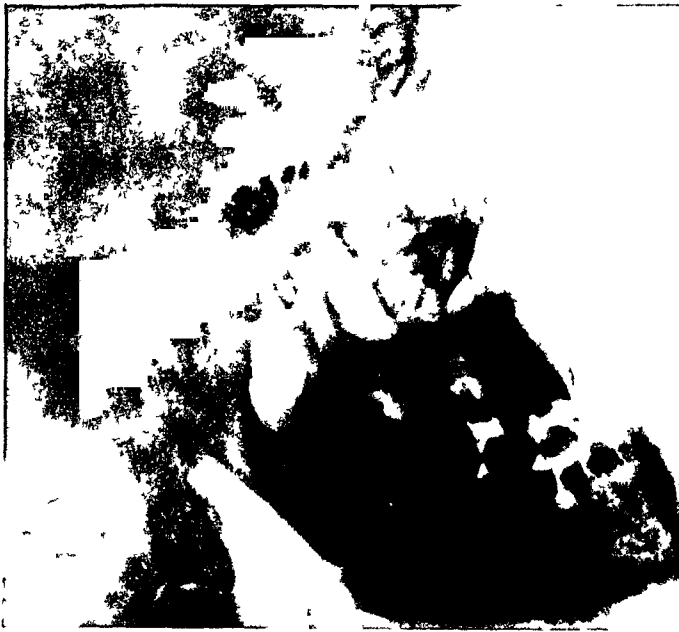


FIG 3—Profile photograph of the affected side in Case I. Considerable prognathism. Enlarged and deformed right capitulum of the mandible. Sella turcica normal

In the bone tissue just beneath the cartilage numerous vascular buds and tufts perforating the subcartilaginous tissues and entering the cartilage all signs of advancing ossification within the epiphysis. Periosteum of the neck normal without distinct traces of hyperproduction of osteoblasts or irritation. There were in the whole section no traces of inflammatory reaction, degeneration or destruction neither of cartilage nor of bone (Figs 5 and 6)

There was thus in the above case a deformation of the mandible in the form of unilateral prognathism, which progressing slowly, developed within eleven years, the main cause of the deformation being a hypertrophy of the head of the condyloid process of the mandible, in minor degree the overgrowth of the whole half of the jaw itself

There are known but few similar cases. Lohmann (1919) was able to record fourteen in the literature, including one of his own. Though carefully reviewing, we could not find more in the recent literature being at our disposal. The case of Perthes, demonstrated 1922 before the German Surgeons' Association at Tuebingen, though apparently similar, cannot be included here. There was a hypertrophy of the mandible more to one side, but the affection of the head of the mandible was absent.



FIG. 4.—Case I. The removed part of the condyloid process of the mandible. The dotted line shows from where the section Figs 5 and 6 was taken.

REVIEW OF REPORTED CASES

CASE I, HEATH—In the case of a female, aged thirty-six deviation of the chin to one side owing to hypertrophy of the ascending ramus and to an exostosis at the head of the mandible developed during a period of ten years. Twenty-five years ago there was an apoplectic insult, with constant paresis of muscles of the now affected side of face.

CASE II, HEATH—In a female, aged twenty, hypertrophy of the head of the mandible and malposition of the teeth. After sodium iodatum administration and the application of anti-rheumatic remedies locally and the deformation was supposed to stop growing.

CASE III, quoted by HEATH—In a female, aged twenty-four, one temporo-mandibular joint was larger than the other.

CASE IV, MCCARTHY—In a middle-aged male right mandibular epiphysis appeared as a bony mass, inverted pyramid-like. The articular surface smooth and flat seemed to be covered with a fibrous cartilage. At the inner aspect of it there was a deep sulcus noticeable passing into a cleft, directed outward and downward to the external surface of the bone. Both the sulcus and the cleft formed the upper limit of a bony mass, which was suggested to be an enlarged articular head. The affected half of the mandible was in all directions larger, than the other. The horizontal branch was in the region of the angle twice as large as the unaffected side.

CASE V, ADAMS—In a female, aged thirty-one, deforming arthritic processes of

almost all joints of the body. There was also deformation of the face and marked limitation of movement of the mandible. At an autopsy the articular cartilage was found

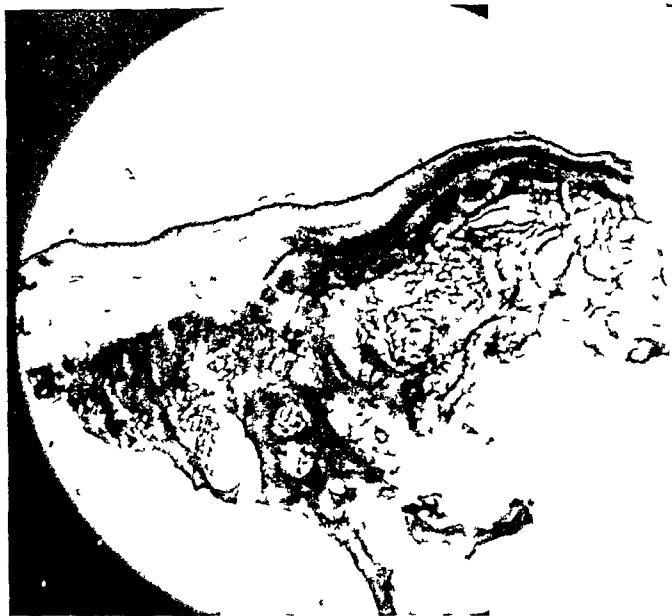


FIG 5—Case I. Microphotograph of a section from the articular end of the removed bone. a Perichondrium b Periosteum c Bone marrow d Columns of cartilage cells e Vascular buds (Zeiss Microtar oc 2. Photograph furnished by Doctor Hilarowicz.)

absent, the neck of the condyloid process markedly lengthened. There was also an exostosis at the last and widening of the glenoid cavity.

CASE VI, EISELSBERG—A man aged forty-two, developed within three years the typical deformation of the mandible, the articular head being of pigeons egg size, the articular surface thickly granulated.

CASE VII, EISELSBERG—In a male, aged twenty-one, crackling and pain in a temporo-mandibular joint, dating back for half a year. The articular head proved to be enlarged and the articular surface rough and uneven.

CASES VIII to X, VOLLKER—The ascending

ramus of the mandible was lengthened by 3-5 cm., the head of it deformed and enlarged reached the size of a nut.

CASE XI, RIEDEL—In an elderly man symptoms of neuralgia of the fifth nerve resistant to any treatment and typical deformation of the face. After resection of the head of the mandible the symptoms disappeared at once. After a time the other temporo-mandibular joint became affected. The patient was also suffering from deforming arthritis in many joints.

CASE XII, GRUBE—In a female, aged seventeen, typical deformation of the face with malposition of the teeth in subsequence of an exostosis at the articular surface, covered with cartilage, unchanged in appearance. The neck of the condyloid process was normal.

CASE XIII, ECKERT and MIKULICZ—A female aged fifty, developed during a period of nine years typical deformity combined with pain and noise in the joint when moved. An operation disclosed an osteoma, size of a plum, at the medial aspect of the articular head.



FIG 6—Case I. Microphotograph of the same section as in Fig 5. High power. a Perichondrium c Bone marrow d Columns of cartilage cells e Vascular buds (Zeiss obj A oc 2. Photograph furnished by Doctor Hilarowicz.)

CASE XIV, LOHMANN and PERTHES —In a female, aged twenty-one, typical deformation of the face and teeth, increasing for a period of one-half a year. The articular head proved to be enlarged with flat surface and with an exostosis at its anterior aspect covered by cartilage.

There can be no doubt that our case, though there is a close resemblance only to the case of McCarthy, belongs to the same condition, containing all its main characteristics.

The clinical picture of the disease can therefore on base of the fifteen above named cases be described as follows. There develops in persons young or of middle age, more frequently in females than in males, otherwise normal (with the exception of two cases with deforming arthritis), unnoticeably or with sudden attack of pain, but mostly without any known cause, an unilateral hypertrophy of the head of the mandible or of both the head and neck and, very seldom of one-half of the mandible, followed by typical deformation of the face in the form of unilateral prognathism and malposition of teeth. The period of development lasts from one to over ten years. There is often some pain present and noise on movement in the joint. The articular head may reach the size of a walnut, is irregularly enlarged and flattened, in most instances covered with smooth and even or granular cartilage. There are also in most cases exostoses at the anterior or inner aspect of the head or neck.

It would appear that the diagnosis is not a difficult one. And it is really so to anyone who has had an opportunity of meeting with description of such a case, for otherwise, as mentioned, the condition is very rare. In our case there were many examinations by internal specialists, neurologists, surgeons and dentists and different diseases were diagnosed, as leontiasis ossea, Paget's disease, and most frequently acromegaly. There are several conditions giving to some degree similar symptoms, as congenital hemiatrophy (Hemignathia Mauclaire), acquired hemiatrophy, facial congenital hemihypertrophy, unilateral excessive rounding of one-half of the face (case of Richelot), or of the mandible alone (case of Perthes), deforming joint changes, syphilitic hyperostosis, inflammatory or traumatic destruction of a part of one-half of the mandible, acromegaly, and at last leontiasis ossea in some of its form. The first named diseases may be excluded without difficulty. Leontiasis ossea was suggested by dentists owing to the fact that there was also a hypertrophy of the whole half of the mandible, of right alveolar process and some signs of overgrowth of the frontal tubera. But even leontiasis ossea in any of its forms, even delayed or only local, should be excluded, for there are no structural bone changes, essential in any form of the above disease: no obstruction of the sinuses or bone canals, and with regard to the localization in the mandible, the head of the condyloid process being the most markedly affected part. In an X-ray picture furnished three years ago, there was a very marked hypertrophy of the condyloid process visible whereas the overgrowth of the horizontal ramus and the upper alveolar process was very slight. We favor therefore the assumption that the primarily affected and the only

seat of the very process is the articular head and neck, or briefly the epiphysis of the condyloid process, the overgrowth of horizontal ramus of the mandible and of the upper alveolar process being due to the want of contact of the teeth in both jaws during the period of growth of the organism. The jaw-bones are very plastic and they react readily with change of shape and size to any injury or to any force acting during this time. As the anatomical findings in all reported cases (15) up to now were identical, we believe we are dealing with a distinct pathological and clinical entity of unknown and, maybe, different etiology, but of typical course and picture.

To explain the genesis of the condition some agents have been taken into consideration.

(1) Eiselsberg and Adams assume on the basis of slow progress of the deformity, on the appearance of the articular head showing roughening and destruction of the cartilage, a chronic arthritic process (mono-articular rheumatic form described by Sandifort,



FIG. 7—Case I Plaster-of-Paris masks. The left before the right after operation.

Eiselsberg), in spite of uni-articular localization, lack of any trauma in the past history, though no changes were found in the subcartilaginous tissue. An arthritis deformans existed with certainty in the only case of Adams. But even there both conditions, arthritis and hyperostosis could be independent from each other. It is hardly possible as stated by Heath and others that deforming arthritis could be able to produce lengthening of the neck of the condyloid process. In our case there is no ground for assumption of arthritis deformans, as there are no signs of cartilage destruction. But an influence of the near inflammatory focus in the ear or of some toxins, descending from it, cannot be excluded as a cause exciting the overgrowth. Possibly the inflammatory hyperæmia of long standing may be a factor sufficient to start the overgrowth of the epiphysis.

Another case observed recently seems to corroborate this view.

CASE II—J. K., female, aged twenty-one, a student. Family and past history unimportant, excepting that for last eight years she was suffering from a chronic right middle ear inflammation, accompanied by pain and discharge from the ear. In the last few weeks there were symptoms of a subacute mastoiditis. Six years ago she noticed slight deviation of the chin to the left and malposition of the teeth. The deformation gradually growing worse. During the last years mastication became impaired.

An examination January 3, 1926. A well-nourished, well-developed girl. The face showed on inspection, that the chin was drawn to the left. Right cheek was fuller

and rounder, left flatter. The middle of the mandible was in comparison with the middle of the maxilla displaced about one cm. to the left. First right upper incisor corresponded to second right lower incisor. The right lower teeth were forced inwardly, while the left ones outwardly from the upper teeth. Mastication was reduced owing to the fact, that the molars met only at their margins. There was also slight prognatism. Otherwise no pain or noise in the joint region.

Other organs with exception of destruction of right tympanum and chronic middle ear inflammation normal.

In Rontgen-ray picture, right articular head and neck of the mandible was found distinctly larger than the left. Also the distance from the zygoma to the angle of the mandible was by some millimetres, longer than to the left. The mandibular angles on both sides somewhat more open than normal, owing to slight prognatism. Otherwise there were no changes in bones of the face, head or others.

The patient was turned over to her ear specialist to be cured of the middle ear inflammation.

This case represents the very beginning of the deformation, which suggests some connection with the middle ear inflammation. But why the deformation is so rare, while the middle ear inflammation in young individuals rather common, remains unknown.



FIG. 8—Case III. Considerable asymmetry.

(2) Also sensitive or trophic changes were considered, as the main cause of the disease in accord with the theory of Trelat-Monod, advanced for the congenital facial hypertrophy and proved experimentally by some authors (Bazelli, Stilling, Lewin, Cl. Bernard, Schiff, Montegazza, quoted by Werner). A sort of hyperfunction of the trophic nerves (Ziehe). In Case I of Heath, the basis of development of the deformation was paresis of the facial muscles after an intracerebral hemorrhage.

(3) The intra-uterine position was supposed by Koelliker and Lohmann, the reduced amount of fluids in the uterus and subsequently excessive unilateral pressure being due to an enlargement of the glenoid cavity, the latter giving then a stimulus to the overgrowth of the head of the condylar process.

Such supposition or a congenital fault may explain the genesis of the deformation in the third case observed in our Clinic.

CASE III—J K, aged forty-nine, a guard in the tramway. Family history unimportant. There were no deformities in his family. The only disease the patient was ever suffering from was small-pox. He was otherwise always well, excepting that he was wounded on the parietal bone in the war (1915). Since he could remember his face was asymmetrical from the earliest youth and his teeth did not exactly correspond. The chin was protruded slightly forward and drawn considerably to the right. He was not able to say with certainty, whether the condition dated from the birth, but he denied to have ever sustained any injury to the face. The state remained unchanged since he became aware of the deformation. The condition never caused any serious dis-

comfort to him, there was neither pain nor noise in the joint. The only inconvenience was impairment in mastication, he often wounded his tongue at taking food. He was not coming in search of help at the Clinic, but he was asked by one of us to call at the Clinic in order to undergo examination.

Examination January 25, 1926—A strong, well-built man. The face showed on inspection considerable deviation of the chin to the right and slight protrusion forward (Fig 8). The left cheek was fuller and more rounded, the right concave.



FIG 9—Case III. The ascending ramus considerably longer the horizontal wider to left than to right.

The most eminent point of the left side of the face was the zygomatic arch, to the right the region of the mandibular angle. Left border of the mandible stood some centimetres lower than the opposite side. The length of the ascending ramus, measured from the lower edge of the zygoma to the lower border of the angle, was 10 cm on the left and 7 cm on the right. The length of the horizontal branch of the mandible equal on both sides eleven and three-quarters cm. The middle of the mandible was drawn about two cm to the right, but when the mouth was closed, the first left upper incisor corresponded to the first left lower incisor, the latter being by a half of its width forced to the right and in front of the upper. Evidently the maxilla became also pushed somewhat obliquely, its vertical axis being inclined to the right. The left lower teeth were forced inwardly, while the right ones outwardly from the upper teeth, the lower alveolar arch crossing the upper one in the level of the incisors. The molars met only with their margins.

The patient was otherwise completely healthy, with exception of slight deviation of the nose to the right. The nose was not obstructed, the intra-oral organs normal and symmetrical. There was also no overgrowth of the skin of the face nor on any other part of the body. The nervous system showed no abnormality.

In the Röntgen-ray picture (Fig 9) the left condyloid process was found to be over one-third longer and by one-half thicker than the right, bent backward and club-shaped. The articular head to be one-half as wide in the sagittal plane and one-third longer in the frontal plane than that of the right. The glenoid cavity also correspondingly enlarged. The rest of the ascending ramus larger than that of the unaffected side but not lengthened. The horizontal ramus larger to the left than to right, of equal length. The vertical axis of the maxilla slightly inclined with its lower end rightward,

but otherwise normal There were in the X-ray picture no structural changes visible in any of the bones

The patient did not agree to be operated upon, as the deformation was not disturbing him

If either of the above stated explanations will prove right, there is still a question to be decided

Pathological Classification—The question of the pathological classification of the disease is still also

an open question

Many names have been used new growth-osteoma, inflammatory process, hypertrophy with a character of a benign tumor or exostosis Lohmann and Perthes, the last to review the subject, called it "tumor-like hyperostosis of the jaw" Our cases merit to be termed overgrowth

Treatment—To influence the progress of the deformity some ways have been attempted, such as anti-rheumatic treatment (Heath), anti-syphilitic treatment (Mikulicz), or in the above case with some

organotherapeutic remedies without any noticeable effect with exception for Case II of Heath The correction of the deformity itself is possible, of course, only by operative measures In our Case I with regard to the fact that the whole half of the mandible was enlarged, two methods were considered

The excision of a part from the continuity of the mandible, unilaterally or bilaterally, a method advised by Blair for the treatment of prognatism and employed in various modifications, or resection of the head of the condylar process of the affected side, described first by Bottin (1872) and then by Koenig, was advised for prognatism, bony ankylosis irreparable luxations of the mandible

The first method is more troublesome to the surgeon because of difficulties of the double cutting of the bone, necessity of applying more or less complicated splints to hold the fragments and more dangerous to the patient on account of the possibility of lesion of the gum and of a pseudo-arthritis



FIG 10—Case I The patient after operation

formation. It necessitates the extraction of healthy teeth and dividing of the nerves and vessels in the canals of the mandible. It requires also long after-treatment, annoying to the patient because of the impairment of taking food and—the main objection—it leaves the articular head, the very focus of the disease, untreated, thus giving a possibility of an eventual recurrence.

The other method, which has been employed by all who operated for the disease in question (Heath, Eiselsberg, Voelker, Riedel, Mikulicz, Perthes), is a considerably smaller operation, permitting an early movement and use of the mandible. The only objections to this method were the difficulties of approaching to the temporo-mandibular joint itself. There are numerous important structures in close proximity to the field of operation, among which may be mentioned the facial nerve, the internal maxillary, temporal and carotid arteries, the parotid gland and Stenson's duct. Several times there were lesions of the facial nerve reported after operations in this region (Mikulicz, Voelker, Bockenheimer, 20 per cent of all operated cases) of the parotid gland (Carr), or internal maxillary artery (Carr). In such an instance, as described above, the enlarged capitulum causes considerable displacement of soft structures and one can never be sure enough of avoiding an injury to any of them. The question of skin incision is very important therefore, and it is not surprising that a considerable number of methods of skin incision were recommended. The small curved incision, as advised by Koenig, Lexer, Wrede, Ashhurst, and others, made in the above case permitted one to avoid a serious lesion of the seventh nerve or of the parotid gland, but the removal of the enlarged head of the mandible was somewhat difficult and probably only to manipulation with it is due the temporary paresis of the nerve. Some writers oppose the use of a chisel and mallet upon the skull, particularly the base of the skull near the mastoid and maxillary articulation, because of possibility of thus producing a fatal shock (Carr). But we believe that when chiseling is made in the direction away from the base of the skull, as has been done in our case, no shock can be produced, especially when one operates upon a mobile bone of the face skeleton.

The operation has given both an excellent cosmetic as well as functional end-result (last examination January 29, 1926). The scar of the operation was scarcely visible and the deformation of the face disappeared (Fig. 10). There remained only a slight lowering of the lower border of right half of the mandible due partially to the widening of the jaw itself, partially to overgrowth and deformation of the alveolar process of the right maxilla the teeth of the affected side being now in contact under the stump of the condyloid process from reaching the bottom of the glenoid cavity. It causes, however, no impairment of the function, the mouth can be opened to full normal width and normal power if mastication is present. The resection of the head of the condyloid process is the simplest way of curing such a deformity.

When are such cases to be operated upon? Is there any ground for waiting till the condition becomes stationary, as for instance, in the case of

Lohmann? On the base of the probability that the centre of the gravity of the condition is the epiphysis of the condyloid process being the very seat of the disease, we believe that in every stage of the development of the deformation we are able to control its progress and to cure the patient definitely by removing the affected part. The earlier the operation is done, the smaller the deformation will develop in the upper jaw and position of the teeth, requiring troublesome after-treatment. It is especially important in individuals during the time of the growth of the organism. We believe in such a case the earliest resection of the articular head is not only advisable, but even absolutely indicated.

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THE PREVENTION OF POST-OPERATIVE THYROTOXICOSIS BY POST-OPERATIVE IODINIZATION

By JOSEPH L. DeCOURCY, M D

OF CINCINNATI, OHIO

SINCE the epoch-making discovery of Plummer, that iodine has specific affiliations with the treatment of exophthalmic goitre, a wave of enthusiasm has spread over the medical world. In spite of repeated warnings by men who are studying goitre in all its phases, huge doses of iodine have been thrust upon all sorts of goitre types in an unscientific manner and with more or less disastrous results. This, however, was to be expected, and follows in the wake of every phenomenal discovery. There are numerous observers, however, throughout the world who have been studying and experimenting with the true value of iodine and are slowly but surely placing it in its proper category. These men of vision have not underestimated its value, but by their conservative methods are preventing it from unwarranted discard, because of its reckless use.

Iodine, in the form of Lugol's solution, may be termed a temporary specific in exophthalmic goitre. That it has a permanent curative value has not been our experience and has not been claimed by Plummer or his associates. Whether we accept the theory that an incompletely iodized molecule is the underlying cause of the toxæmia in exophthalmic goitre or not is of little importance from a practical viewpoint. We do know, however, that when intelligently given, iodine will temporarily check the symptoms of toxæmia and will cause the patient to return to a normal balance and will allow them to regain in part at least, that which was lost. Because of this it has been found that this is an excellent means of preparing these patients for operation. Where formerly operations for exophthalmic goitre were dreaded by surgeons because of the resulting reactions shortly following and were frequently done in stages (ligations, etc.), it is now possible in many instances to do a safe one-stage operation and have very little resulting reaction. There are exceptions to this rule, however, and reliance on this method alone may give a sense of false security which may, not infrequently, lead to disastrous results. We must remember that we are operating on a patient with a goitre and not a goitre with a patient.

We have observed that if a patient has lost a great deal of weight and that the myocardium is unstable, it is still better to ligate the superior thyroid arteries, even though the patient has been iodized with Lugol's solution, than it is to do a primary thyroidectomy. By doing this the patient has a longer time in which to regain her strength, and will make a better recovery.

In patients of recent illness this is unnecessary. During the past year we did ligation in about 30 per cent of our exophthalmic cases. This may seem

POST-OPERATIVE IODINIZATION

ridiculously high after reading reports from a number of clinics, but has seemed to be a factor of safety from which we could not deviate. We have also had a number of purely hyperplastic cases which did not respond to Lugol's solution. In two of these there was marked exophthalmos. We felt for a while that our clinical diagnosis may have been wrong, but they were verified by repeated sections.

Toxic adenoma has not been benefited in our experience, by iodine medication, and I believe in a number of instances it has made these cases more toxic. However, Lugol's solution has changed the handling of these cases in many instances.

In most goitre clinics it is considered more difficult to handle extreme toxic adenoma cases than any other type of goitre, including exophthalmic cases. Ligation is of apparently no value. Preliminary iodine medication is of no value, therefore it is extremely difficult to lessen the resulting reactions, which are not infrequently fatal. During the past year we have handled all of these cases in the following manner and have had no deaths, although a great many were in extremis and were suffering from decompensated goitre hearts before coming to us.

The patient is placed at rest in the hospital. If there is decompensation, sufficient digitalis is given (gtts. 10 every four hrs.) until compensation returns. If there is no decompensation and the heart-beat is regular, then the patient is digitalized with three doses of tincture digitalis of thirty minims each, about ten hours apart. A soft diet is given and they are encouraged to take large amounts of water and fluids.

One-half hour before operation the patient receives morphine gr. $\frac{1}{4}$, atropine gr. $\frac{1}{150}$.

The operation is performed under nitrous oxide-oxygen and both lobes and isthmus are removed. The wound is left open and packed with saline gauze. As soon as the patient returns to bed she receives thirty minims of Lugol's solution per rectum. This is repeated in eight hours. Fluids are given per rectum and encouraged by mouth if they do not cause nausea. The following morning the wound is closed with gas anæsthesia, in the room.

We have noticed a remarkable improvement in the convalescence of these patients with an absence of the muscular tremor, tachycardia, restlessness, fever which was so common before. During the past year we have seldom seen the temperature exceed 100.5 rarely 101 and the pulse 120, and we believe that it is due entirely to the post-operative use of Lugol's solution. For these observations we now look upon post-operative thyrotoxicosis following removal of toxic adenoma the same as that following exophthalmic goitre and believe that both may be prevented by immediate post-operative iodination.

It has become a pleasure to us in treating these cases which formerly caused so much concern, to now see their smooth and uneventful convalescence.

In the mixed exophthalmic and adenomatous gland iodine has not been of value in the pre-operative treatment but has been of distinct value post-operatively.

DISSECTION OF THE AXILLA IN RADICAL OPERATIONS FOR CANCER OF THE BREAST¹

By JOHN E. JENNINGS, M.D.

OF BROOKLYN, N. Y.

SURGEON TO THE BROOKLYN HOSPITAL

THERE is a little danger, I think, perhaps more than a little in some parts of the world, a danger at any rate that the surgery of cancer in availing itself

of radium and the X-ray, may be too much inclined to spare the knife

Certainly I am sure that this is true of the surgery of cancer of the breast, and by this I do not mean to deplore the attitude of those who are defining for themselves the field of operability. It is as unwise to attempt a radical operation on a case in which the incision passes through malignant tissue as it is to incise the malignant tissue in a half-hearted attack on a cancer in its early stage



FIG. 1.—Involvement of the axillary skin in carcinoma of breast

Unfortunately, we are never quite in a position to say that a cancer of the breast is limited, but unless we are willing to give up the surgical attack, with the hope of removing all the disease, we must cling, in suitable cases, to the radical operation

The radical operation for cancer of the breast should be one which surrounds, by its dissection, the area of possible affected tissue and ablates it without incising, disturbing, or in fact seeing any carcinomatous tissue. This is, and has been, the plan of the operation since the days of Banks and Gross.

Beginning with the incision, which surrounds the grossly visible disease, extending this to the axillary fascia and glands, then to the pectoral muscles and to the epigastric fascia, each advance has extended the range of dissection, yet for some reason all of these incisions have persistently ignored the fact

* Read before the New York Surgical Society, March 10, 1926

that the dissection of the axillary skin at the very beginning of the operation invades an area, in fact the area of active lymphatic dissemination. To be sure in some cases it may be possible to reflect the skin of the axilla without reaching deep enough to invade the zone of advancing carcinoma, but Handley has shown how this lymphatic permeation extends from the larger lymph-vessels into the surrounding tissues and even up to the skin itself.

Handley says "Stated in the most general terms possible, the object of the operation should be the removal, intact, of the permeated area of the lymph-vascular system which surrounds the primary growth and of the lymphatic glands which may have been embolically invaded along the trunk lymphatics of the area concerned. How are the limits of this permeated area to be defined? It is impossible to see it with the naked eye. The operator can therefore only aim at keeping a safe distance from it." This broad and sane principle laid down, he however proceeds to modify it in such a way as to practically nullify its use in practice. In discuss-

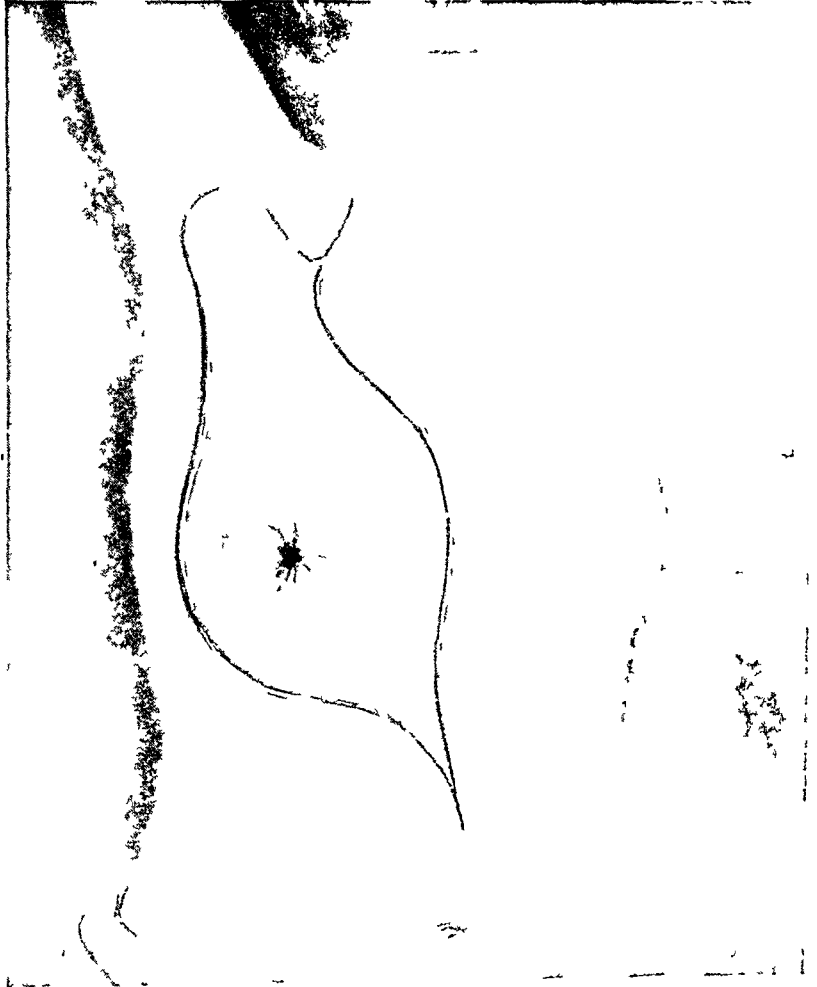


FIG 2 — The incision

ing the removal of skin taken away in the operation, which should obviously be no larger than is necessary and no healthy skin should be removed. It has been shown that cancer does not spread in the planes of the skin, but nevertheless free removal of skin is necessary owing to the vertical extension to the skin after a time and over a small area of the growth which is spreading in the deep fascia.

In an early case of carcinoma of the breast without evident axillary gland involvement, no gross invasion of the skin of the axilla will appear, but in many more advanced cases a close observation of the axilla will reveal retraction and even fixation of the skin to the deeper parts. It seems reasonable to suspect the presence of microscopic deposits in these tissues even in early

cases Is it wise then to plan an incision which is intended to surround the disease so that it crosses and dissects this dangerous area?

There can be no doubt that in many cases in which this is done a local recurrence in the skin of the axilla reveals the fact that malignant tissue was left beneath the skin. The fact that in most of these cases generalized metastasis has occurred at the time when the skin involvement is noticed and is accepted as proof that the disease was beyond help from the first may perhaps be offered as another contribution to what Banks called, in 1871, the



FIG 3 —The sutured wound

effect of inadequate surgery on the Theory of Cancer of the Breast

Is it not possible that the invasion by the surgeon of an area in which young cancer cells are spreading may offer a rapid dissemination even in cases in which no local recurrence has time to appear?

It has appeared that the axillary skin should be considered as a dangerous area and removed in routine with the breast, the pectoral muscles, the entire axillary contents en bloc and a wide dissection of the deep fascia

In the incision which I have now used in more than one hundred cases this is done and the skin of the lower axilla instead of being entered by the incision is removed in one piece. The skin is dissected back over the surface of the latissimus dorsi and is sutured in a Y so that the arm is not hampered.

In a series of seventy-two consecutive cases studied recently, sixteen were untraced, leaving fifty-four cases, of which thirty-six had passed the three-year point free of recurrence, a percentage of 66, three-year cures. There were 14, five-year cures—25 per cent, and it may be worth noting that I have not observed an axillary recurrence in any case.

In many cases of advanced cancer of the breast the skin of the axilla is found involved. In a smaller number of advancing cases early and low

THE AXILLA IN CANCER OF THE BREAST

involvement can be detected. It is logical to suppose a microscopic invasion in comparatively early cases. It is the custom to ignore this fact and to plan incisions for the radical cure of cancer which invade, cross or dissect the skin and superficial fascia of the lower and middle axilla. The scars of such trans-axillary incisions are frequently the site of local recurrence and it is fair to suppose that a wider dissemination of the disease has been favored by such an operation.

An operation is offered in which the skin incision surrounds the skin of the axilla and in which the axillary skin, fascia and glands are removed en bloc with the pectoral muscles and a wide area of deep fascia. The cicatrix of this operation does not limit the motion of the arm.

It is recognized as a general principle that attempts at radical surgery of cancer of the breast should be planned to completely surround the disease. This operation is offered as a more complete compliance with this demand.

A STUDY OF THE ACCESSORY PANCREAS

WITH REPORT OF ONE CAUSING CONGENITAL PYLORIC STENOSIS

By KELLEY HALE, M D

OF WILMINGTON, OHIO

KLOB, in 1859, was the first to describe an accessory pancreas. Two years later the second paper on this subject bore the illustrious name of F A Zenker.² Although this subject was given such an early and fine start, little has been written upon it until after 1900. A S Warthin,¹⁷ Arthur Benjamin⁴³ and E J Horgan⁵⁰ have written outstanding papers.

At first, the presence of an accessory pancreas was thought to be of academic interest only, but as the abdomen is being opened constantly now, the clinical importance of an aberrant pancreas is being shown. A number of serious and even fatal cases have been reported. I think that I will be able to show that it is an etiological factor, if not the sole cause of congenital pyloric stenosis.

In reviewing the literature on the subject of accessory pancreas in the library of the Cincinnati General Hospital, I kept the above idea in mind.

In 1904, Warthin found 47 cases in the literature and added 2. Up to 1921, 31 cases were added. Twelve cases were found at operation. A number of patients have been operated upon for this trouble since then. Horgan found 2 cases in 321 consecutive autopsies while Opie¹⁰ reported 10 cases in 1800 autopsies.

Locality of Accessory Pancreas, Warthin, 1904

	Cases		Cases
Wall of stomach	14	Diverticulum of jejunum	1
Wall of duodenum	12	Diverticulum of ileum	4
Wall of jejunum	15	Meckel's diverticulum	1
Wall of ileum	1	Umbilical fistula	1
Wall of intestine (not definite)	1	Mesenteric fat	1
Diverticulum of stomach	1	Omentum	1
			—
		Total	49
		Location	53

Horgan from 1904-1921

	Cases		Cases
Stomach	5	Small intestine	1
Pylorus	2	Diverticulum of intestine	4
Jejunum	13	Diverticulum of duodenum	2
Duodenum	3	Splenic capsule	1
Ileum	1		—
		Total	32

Nine papers have been written since Horgan's of 1921. An aberrant pancreas of the gall-bladder⁵⁸ and pancreatic bladder of a cat,⁵³ due to accessory pancreas, have been added to diversify the above locations.

A STUDY OF THE ACCESSORY PANCREAS

Etiology—The cause of aberrant pancreas at once resolves itself into one of speculation, based entirely upon a consideration of the origin and embryological development of the pancreas from two ventral and one dorsal anlagen or matrices. Just how an accessory pancreas becomes separated from the main mass or masses of pancreatic tissue and develops into small but complete functioning organs with ducts, acini and islands in most instances, is hard to explain, especially when we consider their wide distribution.

Horgan does not agree with Zenker's theory of origin from an additional diverticulum causing a single independent gland mass. He states his objections as follows: "The masses would be large and would be found always in the duodenum, whereas, in fact, all the aberrant masses are small and the accessory tissue has been found in the stomach, duodenum, jejunum and ileum, spleen, splenic capsule, mesentery, omentum and umbilicus." Horgan does not think that aberrant pancreatic tissue conforms to Cohnheim's theory of embryonal rests.

Warthin thinks, "It is more probable that accessory pancreatic tissue is formed from lateral budding of the rudimentary pancreatic ducts as they penetrate the intestinal wall, the mass of pancreatic tissue thus formed being snared off and carried by the longitudinal growth of the intestine, either upward or downward."

After a study of the embryology of the pancreas, it seems to me that embryologists, pathologists and surgeons have been content to start their study of the pancreatic origin at the point where the anlage or diverticula appear. Back of this point nothing is said about the cells that constitute the walls of the diverticula.

The study of the origin of the spleen as given by Prentiss will shed some light on a possible and like origin for aberrant pancreatic tissue outside of the duodenum. The following is quoted from Prentiss: "The spleen appears in embryos about 10 mm as a swelling on the left side of the dorsal mesogastrium near the dorsal pancreas. The thickening is due to a temporary proliferation and invasion of mesothelial cells into the underlying mesenchyme, which, meanwhile, has also undergone local enlargement and vascularization."

Now in embryos of 3 to 4 mm pancreatic anlagen are already developed. Therefore to account for those cases of aberrant pancreatic tissue in the spleen and capsule of the spleen, we must assume that a primordial pancreatic cell

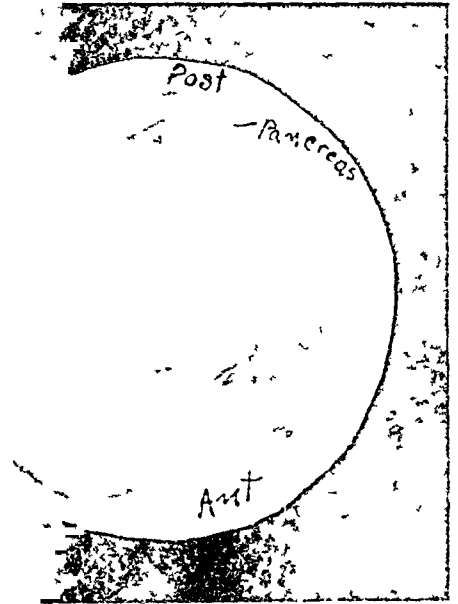


FIG 1.—Low power, showing cross-section of pylorus, in a case of congenital pyloric stenosis. Also severed circular fibre and a triangular aberrant pancreas outlined in ink.

migrated into the dorsal mesogastrium developing into an accessory pancreas along with the spleen. Accessory pancreases located in the great omentum, mesentery, gall-bladder, Meckel's diverticulum and umbilicus can be accounted for in a similar manner. A few years ago, I found an accessory spleen the size of a pea in the great omentum just below the transverse colon. Sections proved its identity.

It is said that the various stages of embryologic development of the pancreas can be found in vertebrata from the lowest form of fish up to man.

Pathology—The pathologic changes reported in a number of cases have necessitated surgical intervention. They have been chronic interstitial inflammation with and without localized fat necrosis in the surrounding tissue, acute pancreatitis, malignant adenoma of the pylorus with obstruction originating in aberrant pancreatic tissue, tendency to intussusception of jejunum, intestinal obstruction from pancreatic tissue in intestinal diverticulum. Harry Cohen⁵² reports a case of ulcer of the pylorus due to accessory pancreas. A number of writers have thought of the possible irritation of the pancreatic juice. Since most of the pancreatic nodules which average 1 cm. in diameter (4.5 cm. largest) are located in the walls of the stomach, duodenum or small bowel, usually in the muscular coats, but sometimes just beneath the mucosa, and since eight of Horgan's and two of Warthin's reported cases did not have ducts, we must consider what are some of the effects of this chemical irritant.

In two cases reported by Carwardine and Short¹⁰ there was great thickening of the jejunum and duodenum. One patient died of pyloric obstruction which they attributed to cancer of the pylorus. No autopsy. It could have been due to muscular hypertrophy due to irritation of pancreatic juice.

In Horgan's two cases there was increase in the interlobular, interacinous and periductal connective tissue. All of the glands located in the bowels have a peritoneal outer covering, that is, in the outer muscular layer.

Hedry⁵⁰ removed an aberrant pancreas from the upper jejunum. The bowel had evidently been irritated for years by the secretion.

My own case of accessory pancreas is herewith reported.

H. W., white, male, aged six weeks who was the second child of his father and the first of his mother, appeared to be normal in every way at birth and had no trouble with his feedings which were from the breast as long as he was in the hospital, which was two weeks. During the third week of his life he began to vomit which was projectile in character. Various formulas were tried by the attending physician, Dr. V. F. Hutchens, but the vomiting persisted until the physician became suspicious that he was dealing with pyloric stenosis. The patient was taken December 26, 1926, which was during the sixth week of his life to Doctor Lamb, of Cincinnati, who confirmed the diagnosis of congenital pyloric stenosis. I was called the day following to operate upon the child at the Children's Hospital, Cincinnati.

Operation—Rammstedt's operation was performed in the following manner. A right rectus incision was made over the pylorus. (I had felt the child's pyloric region a few days previously and thought that I could detect something but was not sure.) The mass that had been previously felt was above and just to the right of the umbilicus about

an inch. On introducing my index finger into the abdomen, the hard mass was encountered about the size of my thumb at this point. It was grasped with sponge forceps and brought up within reach and withdrawn from the abdominal cavity. The pylorus was enlarged to three-quarters of an inch in diameter and one and one-quarter inch long. With the mass supported between the thumb and index finger of the left hand, the fibres were carefully divided with a small nasal septum knife, the inner fibres were broken apart by stretching the incision with a pair of Kelly hæmostats, permitting the submucosa to bulge into the incision and thereby afford relief from the stenosis.

The tumor was solid, light in color and gave one the impression of cartilage as the fibres were cut and divided. It was friable, making it difficult to ligate the bleeding points. A cartilaginous ring shading off into the stomach and the duodenum would describe the gross pathology accurately.

FIG 2—Showing low power microphotograph of a triangular shaped accessory pancreas embedded in the musculature of congenital pyloric stenosis

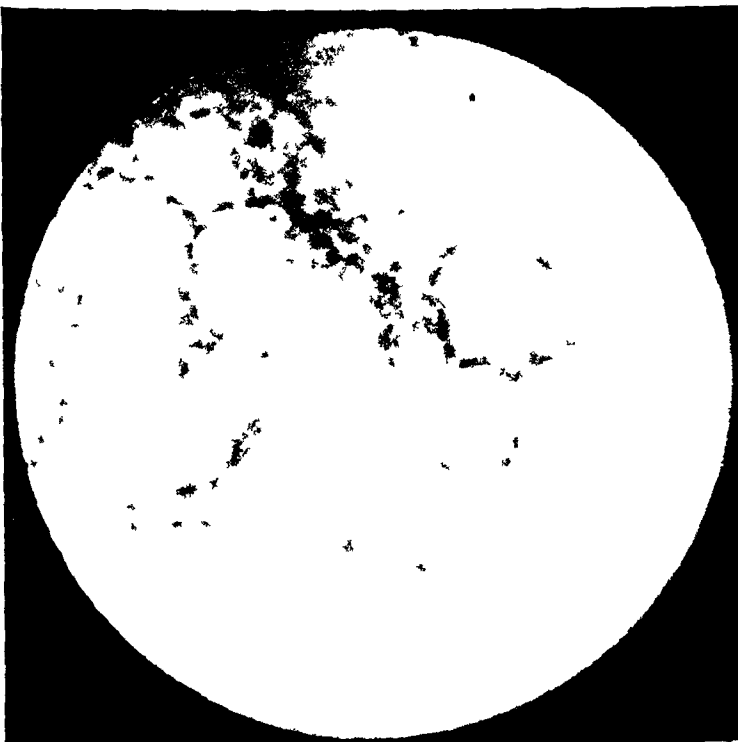


FIG 3—Showing high power microphotograph of Fig 2

Result of Operation—The patient's pulse was good immediately following operation. He retained water and his feedings. Next morning Doctor Lamb noticed the patient

The bleeders at each angle of the incision were controlled by hot packs and ligatures of silk. The pylorus was then dropped back into the abdominal cavity and by means of a retractor, it was observed for hemorrhage. No hemorrhage being noticed, the abdomen was closed. Chromic catgut was used for the peritoneum. Three stay sutures were introduced going through the fascia and this layer and the rectus muscle were closed with interrupted sutures of chromic catgut. Michel's clips united the skin and the stay sutures were secured over a strip of gauze saturated with alcohol. A sterile dressing was applied.

pale and also noticed some oozing on the dressings and ordered hæmostatic serum. About noon Doctor Lamb called me, stating that the baby was in a very critical condition. I ordered a transfusion of blood, but the patient died before the order could be carried out.

We were permitted to reopen the incision and examine the pylorus. There were several sponges full of free blood and a small blood clot the size of a hazlenut. The mucosa at the site of operation was intact. The pylorus with adjacent stomach and duodenum were removed for microscopic examination.

Miss Kathryn Williams, pathologist to Kelley Hale Hospital, made serial sections of the pylorus and noted a small nest of glands located in the muscles at the posterior side of the pylorus.

Figure 1. A low power picture of a cross-section of the pylorus 1.6 cm. in diameter, showing the greatly thickened muscular wall severed by the Rammstedt operation, also the location of the misplaced pancreatic tissue which is on the opposite (posterior) side to the divided fibres. The muscle wall at this point is 6 mm. thick. The accessory pancreatic tissue, triangular in shape 1 mm. by 0.5 mm., lies 2 mm. from the surface of the pylorus.

Figure 2 shows photomicrograph of triangular area of aberrant pancreatic tissue. Ocular No. 1 Obj. 2/3. As can be seen there is a great increase in the thickness of the interlobular connective tissue while the cells of the interacinous tissue are enlarged and have large deeply staining nuclei which make the acini stand out as if outlined by a pen. The cell walls of the acini cells are clear cut and the cytoplasm clear, but the nuclei are more or less indistinct, although some are well-stained and clear cut.

Seven sections show pancreatic tissue. In some the lobules are isolated and of different sizes, all smaller than Fig. 2. A number of isolated acini are clearly delineated and there are a few areas composed of light clear cells which I take to be compressed and distorted acini. There is a large thick-walled artery in the field, but no evidence of ducts can be made out. I found one islet of Langerhans. No inflammatory cells were noted within the pancreatic tissue or hyperplastic muscle coats.

Longitudinal sections of the pylorus showed large bundles of hyperplastic muscle fibres. The connective tissue surrounding these bundles was œdematous but not increased in amount. There were œdematous spaces as large as the individual muscle fibres and about in equal proportion, giving the appearance of a very fine sieve under low power of the binocular microscope. The diameter of the mucosal area is 5 by 8 mm. The submucosa is thickened and the nuclei of the cells are large and take a deep stain. The cells of the mucous membrane are clear cut and stain beautifully. The blood-vessels show thickening of all the coats. The cut ends of the circular fibres are separated as shown in Fig. 1.

Comments on Case —1 The pathologic picture conforms in every detail to that of congenital pyloric stenosis as does the clinical findings.

2 The aberrant pancreas is 4 mm. from the lumen of the pylorus with no evidence of ducts.

3 Many writers agree that pancreatic secretion can produce chemical irritation as proven by case reports.

4 I believe that the activity of the cells of the aberrant pancreas described before, irritated the musculature of the pylorus in this infant to such an extent as to cause pathologic changes in this case.

5 I do not think that congenital pyloric stenosis is due to spasm, but I believe, as does John Chadwick Oliver, as he states, "Like most functional disturbances, investigation will probably show a direct underlying cause." I feel that I have discovered it in my own case at least. Doctor Dudley Palmer states, "All cases of congenital pyloric obstruction have a constant

A STUDY OF THE ACCESSORY PANCREAS

pathology that rests on a far more tangible basis than any 'spasm' theory. The spasm explanation is too elusive to satisfy the materialistic doctor of to-day."

6 I can not believe that it is a coincidence to find an aberrant pancreas and typical pyloric stenosis together

7 I would suggest that serial sections be made of any pylorus removed at autopsy showing congenital stenosis to determine whether or not my assumption is correct

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EXTERNAL FECAL FISTULA FOLLOWING APPENDICITIS*

By JOHN B. DEEVER, M.D.
OF PHILADELPHIA, PA.

As a result of many years of close fighting acquaintance with that arch-enemy of mankind, acute appendicitis, it has been my custom to state that the pathological possibilities of acute appendicitis are without limit. Its depredations lead into many and diverse paths. It is my purpose in this paper briefly

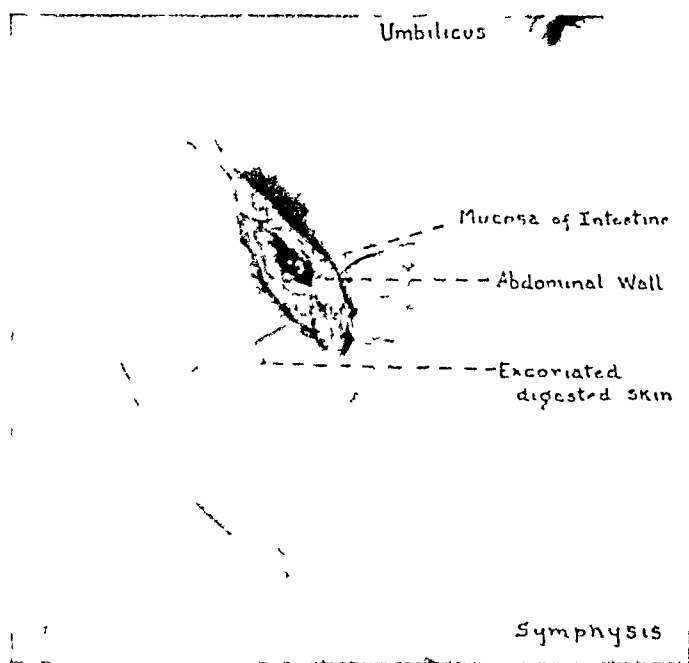


FIG. 1.—Fecal fistula following appendicitis

to call attention to one of these paths—fecal fistula—which is among the most unpleasant complications, mentally as well as physically, which the victim of an acute appendicitis may be called upon to bear. These patients often feel themselves outcasts from polite society and are prone greatly to magnify their more or less fancied repulsiveness. The incidence and methods of relief are therefore, of no mean interest and importance.

The local as well as the general results of fecal fistula depend upon the distance of the fistula from the stomach and the amount of intestinal contents that escapes. A fistula of the large bowel does not impair the general health, which is also true to a large extent of fistula of the extreme terminal ileum, but a fistula high up in the small intestine will cause death from inanition, therefore operation cannot be made too early.

Much is to be learned by careful examination of the intestinal discharge, the responsibility for which is left to the research laboratory, where careful chemical and other examinations are made. In small intestinal fistula the surrounding skin is inflamed, excoriated or becomes digested, a very painful condition and one that it is difficult to relieve (Fig. 1). The odor of the discharge is not necessarily characteristic of a fecal fistula, since colon bacillus pus also gives a fecal odor.

Two years ago I reviewed this same subject on the basis of cases occurring

* Read at the joint meeting of the New York Surgical Society and the Philadelphia Academy of Surgery, February 10, 1926.

FECAL FISTULA FOLLOWING OPERATIONS FOR APPENDICITIS

at the Lankenau Clinic. I am now presenting additional cases, bringing the cases up to date.

Fecal fistula as a complication of acute appendicitis, with the exception of an occasional spontaneous rupture of an appendiceal abscess and fistulous formation, which I have seen, is limited to operations in which drainage was used, either gauze surrounded by rubber dam, rubber dam, cigarette drains, glass or rubber tubes. Experience fails to reveal any prophylactic measures in the way of placing such drainage. It occurs with equal frequency whether gauze or rubber is used and almost exclusively where ulceration and erosion of the adjacent bowel by abscess formation and pressure were present at operation. There seems also to be an especial tendency to fistulous formation in cases where the appendix is perforated close to the cecum. This tendency no doubt is due to the difficulty in inverting the appendiceal stump and the friability of the tissues which must be depended upon for reinforcement. No doubt in many instances stitches pull out, either as the result of tissue necrosis or of peristalsis, leaving the everted lips of mucous membrane free to spout forth the fecal stream, as the restraining ligature is absorbed or dissolved. Great care therefore is required in removing the gauze drainage. This should be done steadily and as gently as possible, at the same time the cavity should be flushed with normal salt solution to assist in softening and dissolving the secretions.

The possibility of fecal fistula, however, does not deter me in the plentiful use of drainage in suppurative appendicitis. I have long been in the habit of thoroughly draining such cases, leaving the wound wide open, bridged only by a few retaining sutures. The resultant hernia can be cured, on the principle that a living man with a hernia is better than a dead man without a hernia.

During the past year at the Lankenau Clinic there were six deaths among three hundred and three (303) cases of acute appendicitis, a mortality of

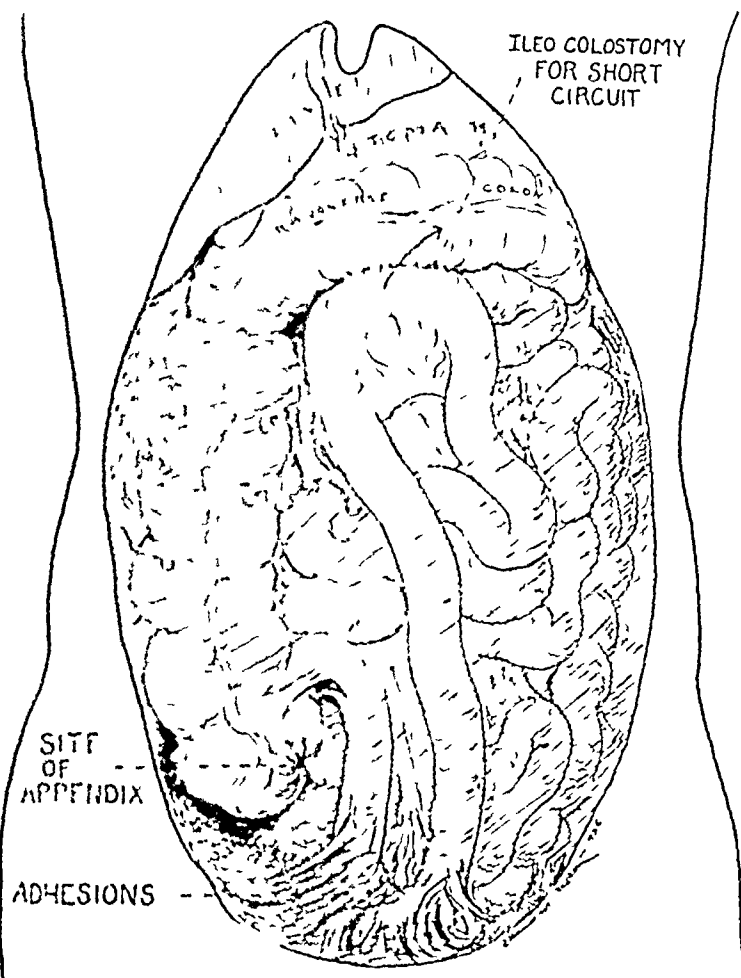


FIG. 2.—Ileo colo tomy for short circuit

minus 2 per cent Included among these admissions there were many of the worst possible type of cases

On opening the abdomen in a case of appendiceal suppuration, the

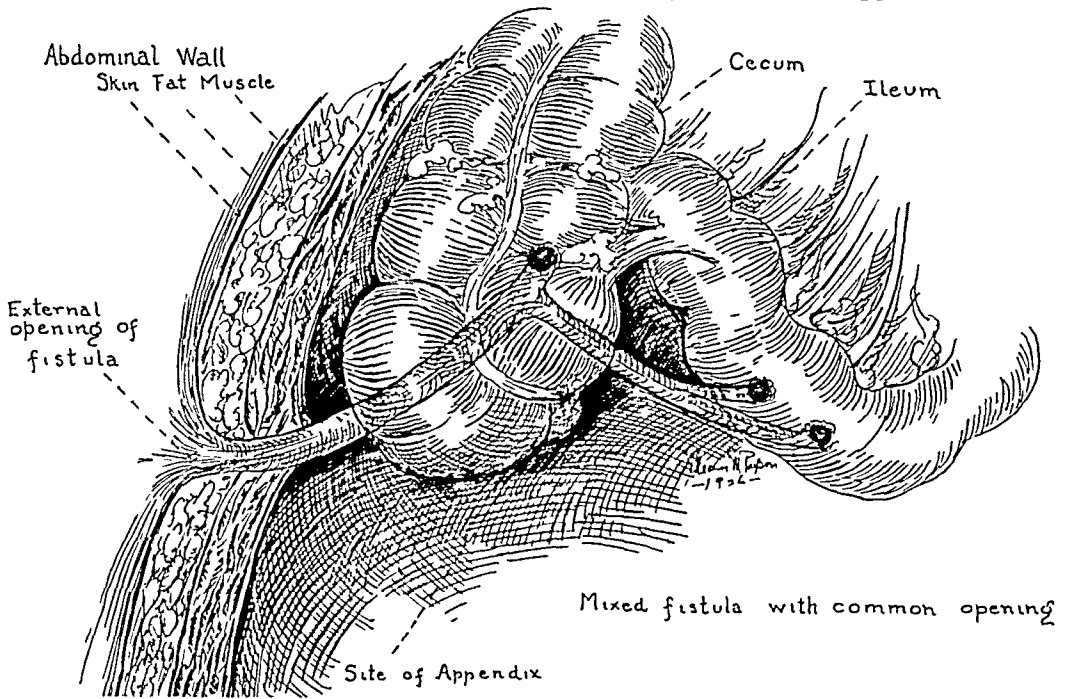


FIG 3—Fecal fistula, mixed type

surgeon often meets with an alarming degree of ulceration of the terminal ileum and cæcum, frequently associated with a mass of adhesions and conse-

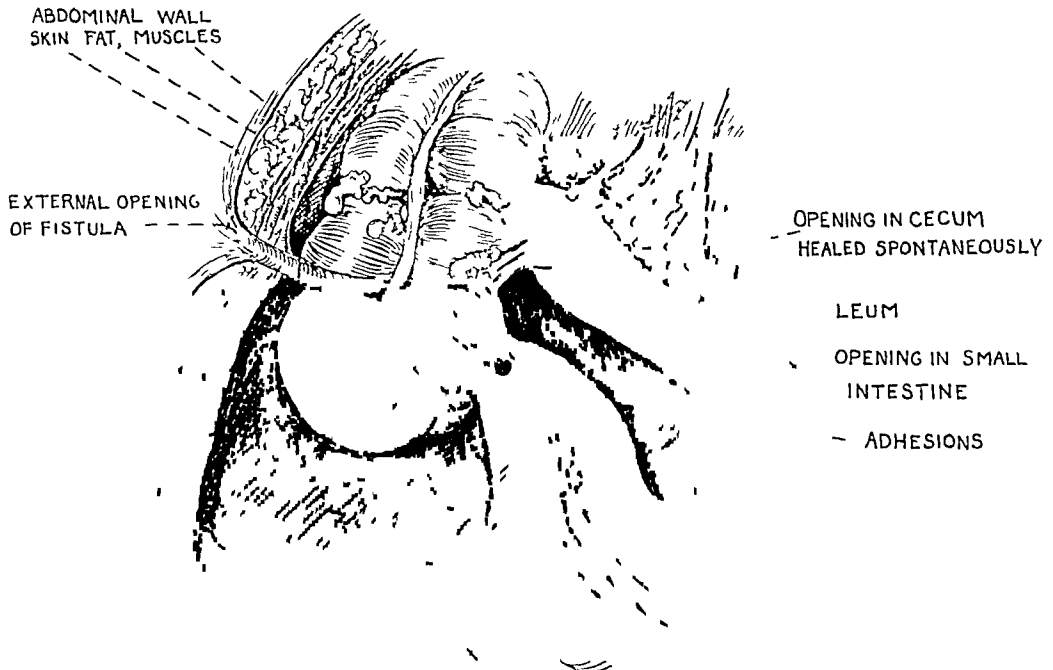


FIG 4—Fecal fistula, mixed type

quent angulation of the bowel This last named is especially apt to occur where a pocket of pus is present in the pelvis Much too often one also here finds

one or more knuckles of ileum plastered down in the cul-de-sac, release of which is tedious and dangerous. In recent years, in cases of such angulation or where repair of the ulcerated area has markedly encroached on the lumen of the bowel, it has become an increasingly more frequent practice with me to finish the operation with an ileocolostomy making the anastomosis at a point above the affected small bowel to the transverse colon, and in some instances in addition one or more

entero-enterostomies (Fig 2) This provides a safety valve for the bowel and in turn prevents intestinal obstruction and very often too a fecal fistula, or, if a fistula does form, as occasionally happens, permits of spontaneous closure of the fistula, except in rare instances. I have often observed such cases, where an ileocolostomy was not performed, develop symptoms of intestinal obstruction between the second and the tenth days, or even later, necessitating a second serious operation or else nature has relieved the obstruction by a fecal fistula which averts immediate operation. But a large

proportion of such fecal fistulas require surgical repair since spontaneous closure is rare because of the more or less permanent partial obstruction, the original cause of the fistula. When I return to the wards each day I view these ileocolostomy and entero-enterostomy cases with a feeling of cheerful confidence in contrast to the forbidding apprehension which the cases present where the anastomosis has not been made.

In a small percentage of mixed fistulas (Fig 3) sometimes two or more operations will be necessary to bring about permanent closure, unless one is bold enough to make an extensive resection with the risk of overstepping the margin of safety in these usually much debilitated patients. I have on occasion made two or three operations with most happy results, as instanced in the case of the patient I am herewith reporting.

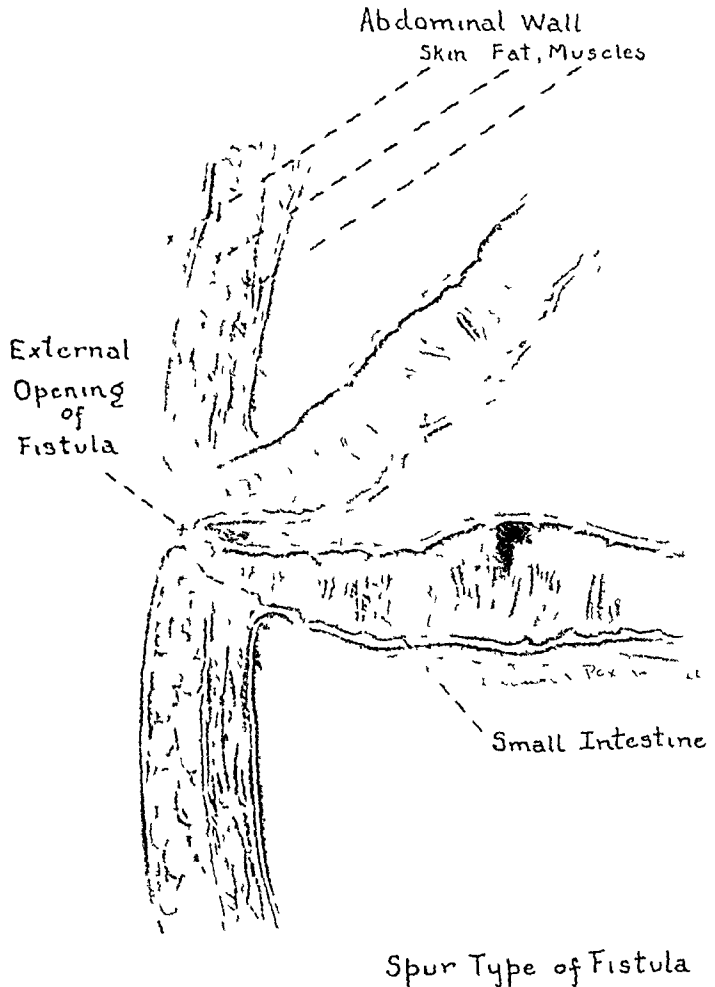


FIG 5 —Fecal fistula spur type

The patient, aged forty-seven years, was admitted to the Lankenau Hospital, August 4, 1925, with diffused appendiceal peritonitis. Lower abdominal tenderness was marked on both sides, the belly was silent with inability to pass gass or to void urine. Treatment consisted of anatomic and physiologic rest until August 15, when the diffused peritonitis had subsided, and there remained a circumscribed peritonitis, with flatus on percussion and extreme tenderness over this area. Operation was done under intra-spinal apothesine, and a perforated appendix found lying lateral to the cæcum and ascending colon, pus was present between the diaphragm and liver, lateral to the colon, in the pelvis with two small collections between the coils of the small bowel adjacent to the cæcum. The pus was

evacuated and the appendix removed. A large sheet of thick rubber dam was placed medial to the ascending colon and the cæcum and extending into the false pelvis, and the wound gently packed with iodoform gauze. Rubber tubes were placed between the diaphragm and the liver, beneath the liver and in the pelvis. The wound was left open and several interrupted sutures placed, simply to hold the drainage in place and lessen the chance of evisceration in the event of vomiting or coughing. Where lavage is practiced in these cases the wound is looked at before and after the stomach washing to insure against overlooking prolapsed bowel or omentum. Failure on the part of the nurse and interne to make this survey nearly cost the writer a thousand dollars in one instance. Recovery from operation

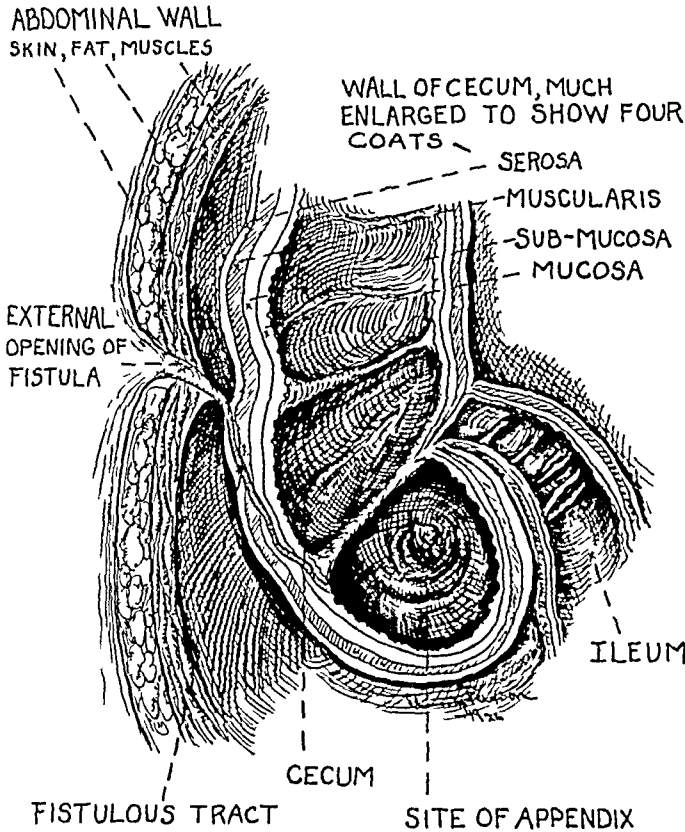


FIG 6—Fecal fistula running through each coat of wall of cæcum (Diagrammatic)

tion took place but later two fecal fistulas developed, one of the cæcum and one in the small bowel in which there were two openings in the terminal ileum.

October 10—I again operated under spinal apothesine, for repair of the fistulæ. The openings were closed with interrupted Lembert chromic gut sutures. Several questionable areas in the small intestine were reinforced with sutures. The operation was terminated by making an ileocolostomy and the wound dressed in much the same manner as after the first operation. The patient recovered but a fistula recurred three weeks later. The third operation was made on November 26 under spinal apothesine, gas and oxygen anæsthesia. The operation consisted of excision of the terminal ileum, cæcum and ascending colon. Complete recovery took place. The patient has been heard from recently and is perfectly well.

Suturing a fistulous opening when it is surrounded by granulation tissue does not accomplish anything, neither does packing the sinus with the idea of inverting the margins of the opening in the bowel and promote healing, accomplish the desired end. My internes occasionally make one or other of these

FECAL FISTULA FOLLOWING OPERATIONS FOR APPENDICITIS

attempts at closure, to which I do not take exception, not wishing to dampen their enthusiasm or stay their ambition. Occasionally, however, healing occurs in the case of a small fistulous opening at the bottom of a long tract surrounded by granulation tissue. When the fistulous tract opens into the cæcum and into the small intestine through one or more openings, making a mixed fistula, operation is the only alternative. Occasionally the opening in the large bowel closes spontaneously, but never do the small bowel openings close (Fig 4)

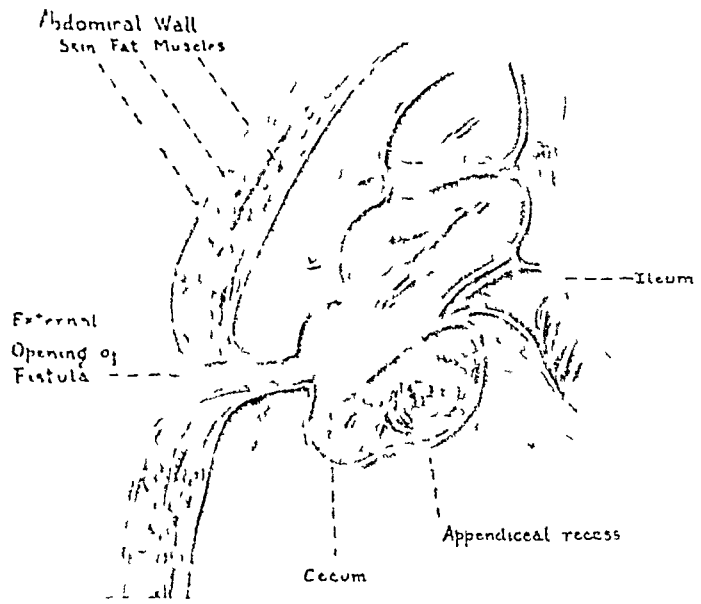


FIG 7—Fecal fistula simple type

One of the drawings I present is of a mixed fistula upon which I operated this afternoon, the opening in the cæcum had closed, therefore I had only to

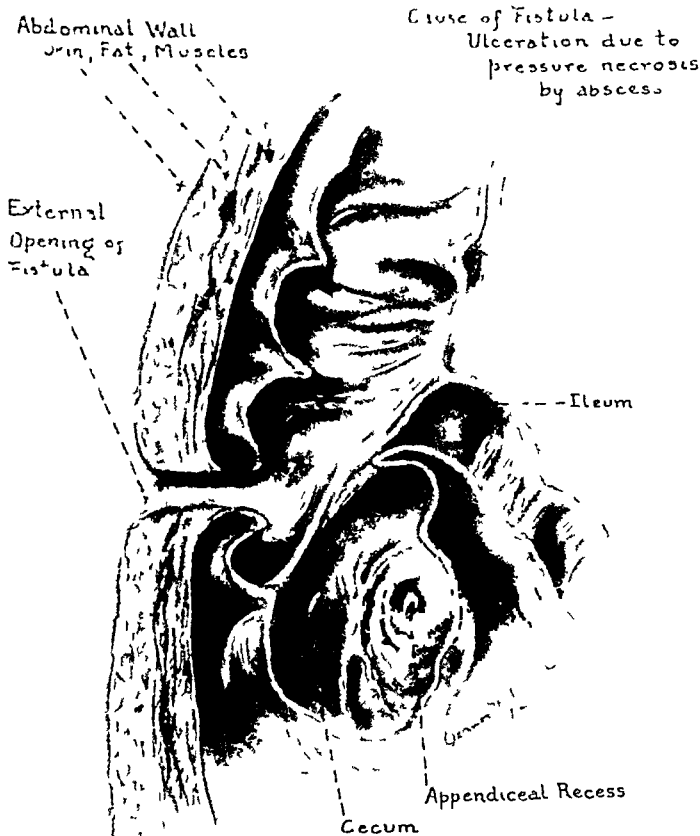


FIG 8—Fecal fistula simple type

close an opening in the small intestine, making the operation simple. Mixed fistulas with large and small bowel openings can be recognized by the skin irritation which they cause, as fistula of the large bowel is not accompanied by skin irritation (Fig 5)

Occasionally I meet with a tiny fistulous tract communicating with the cæcum with a valve-like opening, the tract passing obliquely through the coats of the bowel, the terminal part of the fistulous tract extending some distance beneath the mucous membrane before entering the lumen. I

I have recently operated such a case where neither gas nor fecal matter passed through the fistula (Fig 6)

Records at the Lankenau Clinic reveal two hundred and twenty-two (222) cases of post-appendiceal fecal fistula, occurring among four thousand, six hundred and fifty-five (4655) cases of acute appendicitis, an incidence of slightly less than 5 per cent

Of these 222 fistulas, 86 or 39 per cent healed spontaneously, while 108 or 49 per cent, required operative repair. The remainder, 30 or 13.5 per cent were discharged from the hospital having refused operation, or were sent home to recuperate and to return for operation if necessary, but failed to do so. On the basis of figures gathered by the Lankenau

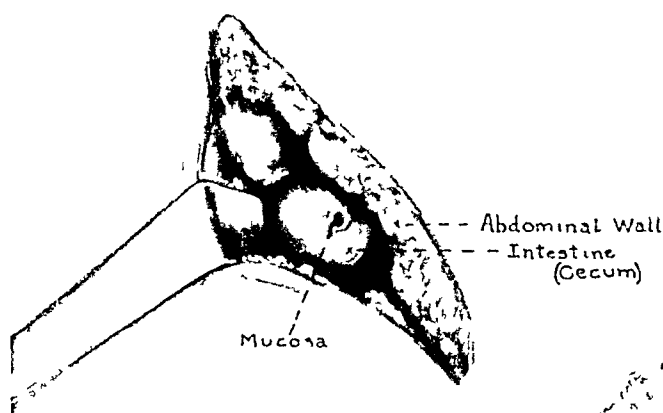


FIG 9 —Fecal fistula following appendicitis

Follow-up Department, the greater number of these fistulas probably closed spontaneously and may be included among that number

The shortest duration of fecal drainage in this series of cases was one case in which the opening closed twelve hours after its presence was discovered, while the other extreme shows a patient who had an intermittent fecal fistula for nine years. As a rule a trial period for possible closure was permitted to pass before operative procedure was undertaken, the length of time depending upon the patient's general physical condition, the

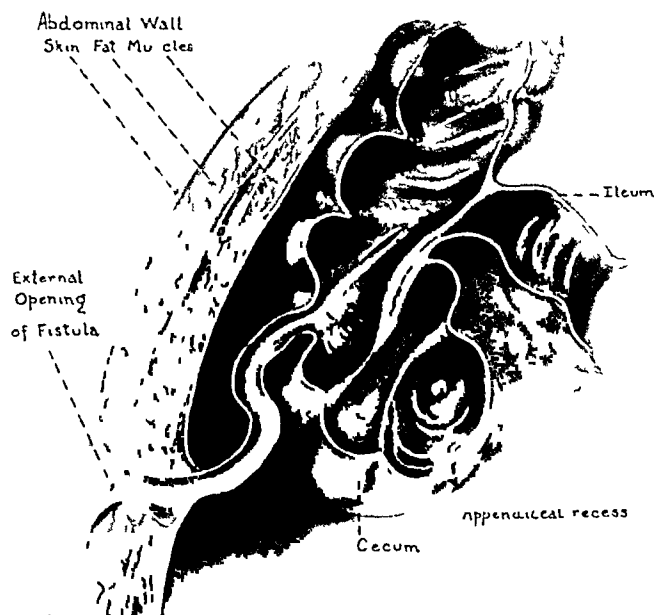


FIG 10 —Fecal fistula

amount and character of the drainage and the mental attitude of the patient

The surgical procedure necessary for repair was dependent of course upon

FECAL FISTULA FOLLOWING OPERATIONS FOR APPENDICITIS

conditions. In 55.5 per cent of cases, simple inversion of the fistulous opening by a purse-string suture followed by reinforcement by an additional suture line was the only procedure required. In 15 per cent of cases the condition of the bowel after this procedure was such as to excite doubt as to its regenerative power in the presence of the usual fecal stream, so that an ileocolostomy was performed to short-circuit the affected bowel. Twenty-three per cent of cases presented either multiple fistulas or else the fistula was so large as to preclude closure with maintenance of the lumen of the bowel. Some cases showed extensive ulceration in the part of the bowel surrounding the fistula, so that hope for the recovery of this portion had to be abandoned. These required resection of the bowel varying from a small portion of the cæcum to resection of a foot or more of the terminal ileum with the cæcum and entire ascending colon. Ileocolostomy was of necessity the last stage of the operation.

Of the 108 operated cases, 89 were discharged from the hospital perfectly healed. In ten instances there was a recurrence of the fistula. These usually healed spontaneously, but in some instances required further resection of the affected portion of the bowel. (Figs 7, 8, 9 and 10.)

THE PATHOGENIC COLON*†

BY JOHN WILLIAM DRAPER, M D

OF NEW YORK, N Y

THE occasional hereditary transmission of certain psychopathic disorders, including epilepsy, has long been an acknowledged fact. The mechanism of transmission has remained an enigma. From time out of mind the inheritance of epilepsy and the so-called functional psychoses has been accepted as an inescapable yoke, passing from generation to generation, and because of our age-old dualistic habit of separating the mind or soul from the body, and of our ignorance concerning the basic laws of heredity it sufficed loosely to concede the transmission of these disorders to the mind. This popular trend of thought away from Vichow savors of mystery and medieval medicine. It is not new. Of all the ancients, the Greeks alone rejected it.¹ From the modern biological point of view such an explanation is inadequate. One has only to read Conklin² or Morgan,³ or to believe in Vichow, to be convinced that since there can be no function of any kind without form just so surely there can be no abnormal function without abnormal form. The origin of abnormality in cerebral cellular form is of necessity either congenital or acquired. It is with the acquired or secondary form that we are concerned, because here an hereditary element which may respond favorably to surgical treatment is often to be found within the abdomen.

The primary or congenital cerebral abnormalities are worthy of more than passing consideration, even though in a biological sense we cannot expect to modify them. Much careful research has been made upon these primary abnormalities of the brain, and it has long since been demonstrated that definite forms of idiocy result from gross and easily recognized congenital cerebral defects. Less severe abnormalities account for the ordinary moron and the so-called constitutional defective. Their symptoms appear soon after birth and post-conceptional environment cannot materially change or improve them.

The secondary or toxic form of cerebral cellular disorder is to be found in those adolescent individuals who have been bright and normal since birth and who have suddenly developed epilepsy or a so-called functional psychosis. The family history may be entirely negative, save that it points frequently to chronic intestinal invalidism. The personal history and physical findings often demonstrate extensive chronic focal infection throughout the body, and not infrequently what has been called a "surgical abdomen." Should such patients, because of mental disturbance, be denied a thorough medical examination and surgical defocalization such as is practiced everywhere for the

* Read before the Association of Ex-Residents, Mayo Clinic, Rochester, Minn

† Aided by a Grant from The Andrew Todd McClintock Foundation

relief of many common disorders? Weitheimer,⁴ in discussing American psychiatry, disposes of the question as follows "The numerous operative procedures represent a degeneration of the pragmatic attitude" Insanity in this country has increased 468 per cent since 1880, while our population has increased 112 per cent⁵ May it not be that our failure to check this rising tide of human waste is due in large part, not only to defects in the established methods of treatment, but also to the utter lack of a comprehensive and biologically correct preventive program? The effect of heredity upon the incidence of insanity is not definitely known, but we do know that in some patients hereditary factors exist which predispose to bacterial or other forms of toxicosis, and which are susceptible to surgical intervention Surely the physical and biological side should not be lost to view in the present effort to stress psychical therapeutics, for there is no reason why the two forms of study and treatment should not be combined

The hereditary transmission of intra-abdominal defects is today an unexplored field, but it is probable that it conforms to the Mendelian law Recent study shows that such defects notably of the colon and omentum, are of frequent occurrence among psychotic and epileptic patients and that they favor the development of an abnormal and destructive flora in the colon They may also offer a satisfactory explanation of the mechanism which transmits neuropsychoses in certain families not known to harbor primary cellular defects of the brain No one can successfully deny that in such families there may be slight congenital abnormalities in the cerebral cells and that these, although not demonstrable, may be present without causing symptoms excepting when complicated by the toxins of focal infection The sources of these toxins are demonstrable and will yield to surgical and medical therapeutics Primary defects of the brain, if present, cannot be changed by treatment The questions of tissue susceptibility and bacterial specificity are of the utmost importance, but beyond the scope of this paper

A colon dysmorphism due to congenital bands and other developmental abnormalities is incompatible with the gravitational drag of the upright posture and is therefore unfavorable to the continuance of the water and gas-tight colon with which we are born For such dysmorphisms, seemingly hereditary, often cause partial obstruction, abrasions and pressure traumatism to the colon tissues, resulting in permeability, destructive ulceration, chronic peritonitis and the symptoms of chronic intestinal invalidism Davenport,⁶ commenting upon certain of the histories and findings pursuant to this research, says "While not yet definitely proven, these studies upon the possible transmission of dysmorphism in the human colon in families are of very great interest and importance I regard them as a valuable addition to our general knowledge regarding the relationship of heredity and environment, and am therefore publishing a part of your report in the *Eugenical News*"⁷

Of the one hundred and seventy-six cases analyzed in this report, and

exclusive of the group of one thousand referred to later, one hundred and sixty-four are from the surgical clinic and the laboratory of the State Hospital for the Insane at Trenton, New Jersey. Of this group, one hundred and forty-nine were psychotic and fifteen were epileptic. The remaining cases were taken from the private files of the writer, and in addition to epilepsy deal with the more generalized symptoms of chronic invalidism. The surgical analysis of the State Hospital cases was made by John W. Churchman, who at the time was in charge of the hospital laboratory. The work as a whole has been under the direction of Henry A. Cotton.



FIG. 1.—Method for closing mesenteric defect and sealing retro-peritoneal space

From a careful study of the functional psychotic group admitted to the State Hospital during the past eight years, it is evident that each patient presents a greater or less degree of focal infection throughout the body, and that serious lesions of the colon exist in fully 30 per cent. The great majority of these lesions are due to dysmorphisms of the congenital type, the remainder to deformities of inflammatory origin alone. Both causes are often present concurrently. Four years ago James Ewing⁸ examined sixteen specimens of colon and ileum chosen at random from the material under discussion. He says "The great majority of the specimens show very definite gross anatomical lesions. The most marked is pigmentation, excessive in the cæcum, but often present throughout the specimen. This pigmentation is fully recognized as a sign of chronic intestinal stasis and intoxication. It is sometimes associated with anemia, and at times with severe and even fatal dystrophies of the nervous and muscular systems.

"Pouching of the intestinal wall amounting almost to hernial protrusions was observed in most of the cases. The wall was sometimes very much thinned, and the mucosa at the bottom was generally eroded, sometimes ulcerated. Through such erosions it is obvious that absorption of fluids and bacteria readily occurs.

"In general the impression gained from the study of these specimens was that the clinicians were dealing with extensive and somewhat unusual

THE PATHOGENIC COLON

grades of chronic intestinal stasis and catarrhal inflammation with its sequels

Important is the demonstration of hernias, pouching, thinning of wall, pigmentation and ulceration of the mucosa, which together form an impressive anatomic basis for the theory of intestinal intoxication, which undoubtedly existed in severe degree in the cases exhibiting such lesions "

Doctor Ewing's full report from which the above is abstracted, is an important document. These details are offered to explain something of the hypotheses which have served as guides in the study of the present series and to show that this work upon the colon far from being haphazard, has been carefully coordinated with well established biological laws and with conservative laboratory findings

The colon specimens belonging to this group, and from which Doctor Ewing's studies were made were removed by the usual technic. It comprised a closure of the peritoneum across the pelvis. This obliterated the mesenteric defect between the termination of the ileum and of the sigmoid but it necessitated

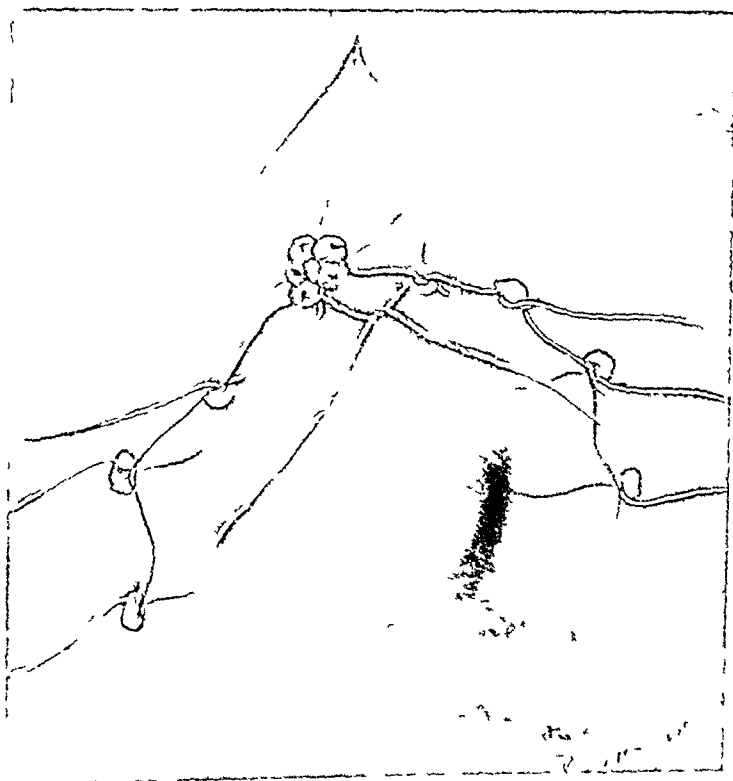


FIG 2 —Method of tying the interrupted sutures

evisceration in order to dislocate the small bowel from the pelvis and often led to post-operative complications. Its most objectionable feature, however, appears to have been that the long suture line extending over the entire area of extirpation was incompletely closed. Coffey⁹ has recently published a method illustrating its closure. The pertinent mortality in the hospital series of one hundred and sixty-four cases was 31.7 per cent. As this was seriously high the technic has been changed as follows. The colon mesentery is left as long as possible and the suture ends are gathered together as shown in Figs 1 and 2. The mesenteric defect between the terminal ileum and the terminal sigmoid is then closed as shown in Fig 3. The result of this is to shut off almost completely the entire retroperitoneum, which under the older technic had been left relatively open to infection. The heterostaltic lateral anastomosis is used as heretofore. Since the introduction of this simple change the pertinent mortality in an unselected continuous series of twenty-five hospital and private cases has fallen to 16 per cent. E. C.

Dudley,¹⁰ commenting upon the resemblance of the mesenteric closure to his own well-known approximation of the pelvic floor after hysterectomy, and which is generally credited with having reduced the mortality of that operation by fully 20 per cent, has said that, employed as above described, it would, in his opinion, ultimately result in lowering the mortality of total colectomy to less than 5 per cent. To Doctor Dudley I am deeply indebted for constructive criticism.

The general problem of the pathogenic colon and its treatment, although

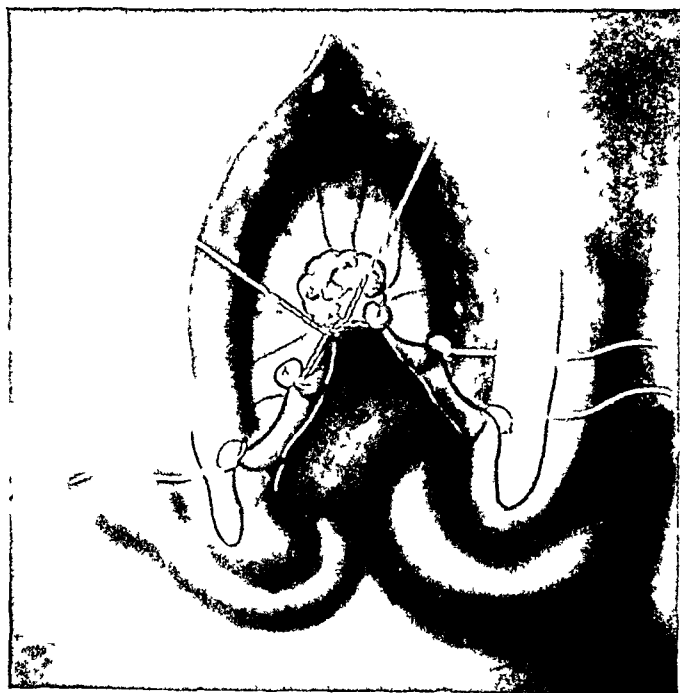


FIG 3 —Mesenteric closure nearly completed and retroperitoneum shut off

recognized as important, is as yet little understood. The following tentative conclusions, based upon study of this series, may therefore be of some value.

Chronic peritonitis, manifested by cicatricial scars upon the mesentery and associated with the breaking down of mesenteric glands, is frequently present. It does not cause much pain and is not associated with fever. It is related to the low blood pressure and hæmic changes reported by Draper and Johnson,¹¹

and is probably the direct result of leakage of bacteria and their toxins through the mechanically damaged colon, as cited by Ewing. Indeed if at operation the serous surface of such a colon is gently stroked after a rectal injection of acriviolet the dye can be observed to ooze through the bowel wall.

Acquired post-operative adhesions are rarely found after a colectomy unless there has been leakage from the stoma. They are more frequently of infectious than traumatic origin. An abdomen which was found at primary operation for colectomy to be filled with adhesions has been observed to be entirely free from them in spite of having been opened seven times (Case 4931).

Chronic diffuse proliferative adenitis is a constant and valuable clinical sign of colonic leakage. It is often segmental in distribution, corresponding closely to the position of the intrinsic colon lesion. The glands usually contain living *B. Coli* and streptococci. Accidental gland section during the laparotomy may account occasionally for post-operative peritonitis.

Omental dysmorphism frequently causes partial obstruction and also axial

rotations of the colon. The bilateral symmetry of omental abnormalities is noteworthy. When the omentum is adherent in the right abdominal gutter it is likely to be adherent in the left. (Figs. 4 and 5.)

Partial intestinal obstruction is of two types. Barber¹² has demonstrated the effect of complete and incomplete mechanical occlusion in the ileo-colic region upon the neuromuscular control of the pylorus, and Satterlee¹³ more recently has published clinical studies upon the causation of abnormal gastro-intestinal reflexes by rectal atresia. Since 1903, obstruction has been the subject of intensive and prolonged study on the part of the writer, Murphy,¹⁴ Whipple,¹⁵ Dragstedt,¹⁶ recently and in great detail, Eisberg,¹⁷ and finally Brown, Eustermann, Haitman and Rowntree¹⁸ have continued this work. Andrew Todd McClintock¹⁹ in 1917, noted another phase of the relationship between the terminal ileum and the duodenum. He says, "A sub-culture injected intravenously in rabbits caused intense hemorrhages of the duodenum, jejunum and appendix."

It is extremely significant that McClintock's findings based upon the reaction to bacterial suspension coincided with those of Barber and Satterlee which resulted from clinical study.

The source of the toxicosis accompanying duodenal obstruction is not yet definitely known, but the hypothesis advanced by the writer²⁰ in 1906, that a part of it at least is not of bacterial origin, but is elaborated by the duodenal epithelium, still remains to be disproven. Indeed the recent work of Miller and Raulson,²¹ who consider epilepsy as a manifestation of anaphylaxis, appears to be somewhat in harmony with it. Some of the lethal product may arise from anaerobic bacteria, as suggested in the study of Draper's material by Torrey²² who has demonstrated the presence of *bacillus histolyticus*. Whatever its source, it is probable that in every definite case of partial ileo-colic mechanical obstruction there is an associated and often unrecognized compensatory duodenal functional obstruction. This results in a complicating



FIG. 4—Right omental deviant

endotoxemia from the duodenal epithelium which directly affects the brain Hassin,²³ in his monograph on multiple sclerosis, considers it due to some unknown toxin, probably an endotoxin In this connection attention is directed to the first paragraph of Ewing's report and also to Cotton's Van Uxem Lectures ²⁴

Constipation is a frequent sequel of partial obstruction It is primarily protective A less frequent sequel, and one in which some of the worst evidences of colonic toxemia have been observed, is diarrhoea This is often a

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Left Omental Deviant Causing Obstructive
Angulation and Localized Areas of Axial
Rotation

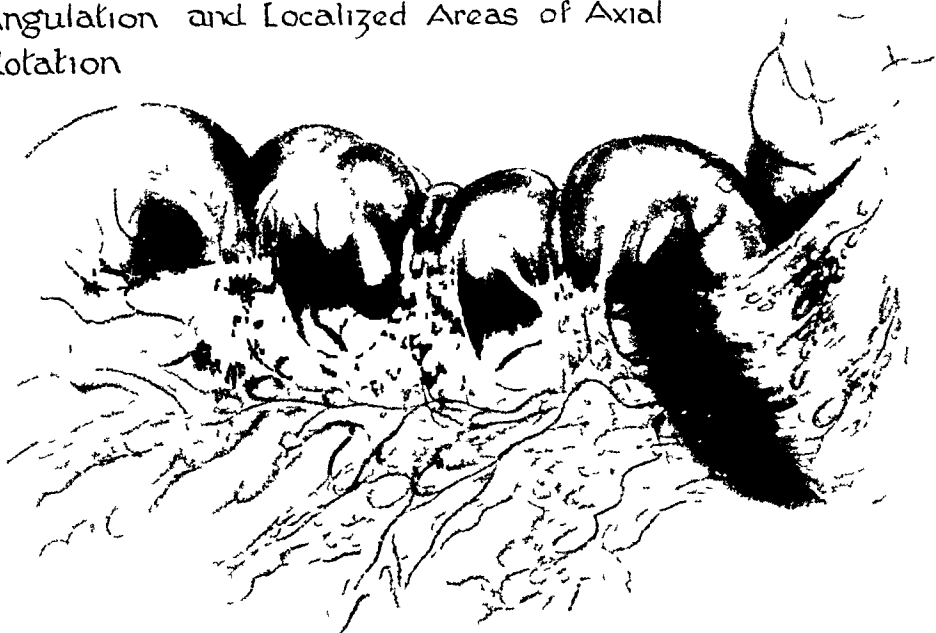


FIG 5 —Typical congenital defect found at operation

form of paradoxical incontinence, the bowel pouches remaining full of hard feces

Short-circuiting —Blake and Brown,² studying hemi-exclusion in laboratory animals, first demonstrated conclusively the impracticability of unilateral exclusion Nevertheless such exclusions are still occasionally resorted to Following ileo-sigmoidostomy the hemi-excluded colon becomes enormously distended, owing to the predominance of the anastaltic waves Fig 6 shows the pathological changes occurring in a loop created without option by the writer four years ago and recently removed It was found to be filled with a foetid red fluid containing a few solid particles and much hæmolyzed blood For six months prior to the final resection the patient had averaged fifteen small stools daily, similar in character to the contents of the loop and presumably originating therefrom Since excision the diarrhoea has ceased, and with it the so-called neurasthenia The principle of short-circuiting is wrong because

it fails to take into consideration the invariable rule that the effluent will not pass through a lateral entero-anastomosis unless the normal path just aboral to it is blocked. The principle of hemi-exclusion is wrong in that it fails to overcome the effect of anastalsis.⁴ Moreover, a leaking colon is left *in situ*.

Physiological Effects of Total Colectomy—Thirst is almost always an immediate post-operative condition. It is not only painfully uncomfortable but seriously detrimental. It is due to the fact that practically all of the water absorbing surface has been removed. Hypodermoclyses of large quantities of one-half and even one-quarter strength salt solution have been used without ill effect or pain.

It may be injurious to the kidneys to inject large amounts of sodium chloride. Immunity to toxic foods may occur. Colectomized patients sometimes state that they are not made sick by the accidental eating of tainted meat or other food which has poisoned others. Diarrhoea amounting to from ten to fifteen watery movements daily, always gradually ceases in from two to three weeks as the terminal ileum takes on vicariously the water absorbing function of the excised colon. Increase in weight is to be expected after the water privation has ceased.

The somewhat prevalent idea that patients are likely to have chronic diarrhoea and to lose weight is shown by a study of this series to be entirely erroneous.

Relationship of the Pathogenic Colon to Neuro-mental Symptoms—From a study of this group of one hundred and sixty-four patients in whom colectomy either alone or combined with other forms of defocalization has been done the relief of symptoms in a fairly large percentage of the cases strongly indicates a connection between toxic factors and the functional psycho-neuroses. This conclusion is based upon the striking disappearance of symptoms shortly after operation and their continued absence for a period of several years under competent field observation. Even allowing for the remissions for which the functional psycho-neuroses including epilepsy are notorious, and for the cases in which there has been little or no change, a group remains in which there has been either complete arrest or very marked

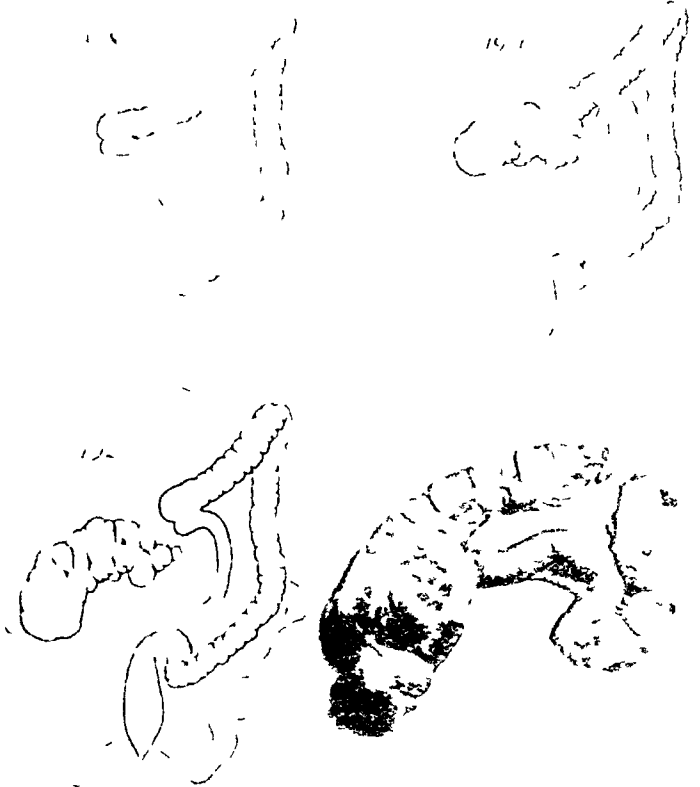


FIG. 6—Pathologic changes in loop of intestine excluded four years ago and recently removed

JOHN WILLIAM DRAPER

improvement Two analogous groups comprising one thousand patients among the so-called functional psychotics were investigated at the State Hospital One group of five hundred consecutive admissions between 1908 and 1911 was treated without detoxication The other group of five hundred consecutive admissions between 1918 and 1920 was treated by detoxication Of this latter group only eighty remained in the hospital at the end of five years (16 per cent), while of the former group two hundred and fifty-six remained at the end of a similar period (51 per cent) The recovery rate in the detoxicated group was 2.3 times that of the untreated group, the ratio being one hundred and forty to three hundred and twenty-eight The mortality in the detoxicated group was 13 per cent, while in the untreated group it was 13.2 per cent ²⁷

Finally, it seems probable that dysmorphisms of the colon and omentum are dominant, and that this in part explains the occasional hereditary transmission of certain nervous and mental disorders and their apparently spontaneous occurrence in high-grade families The discovery and correction of such intestinal and omental anomalies in childhood, before the colon has been permanently damaged, is unquestionably the first and most important step in dealing with the problem This is preventive surgery ²⁸

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PRIMARY TUBERCULOSIS OF THE GALL-BLADDER

By FRED W. RANKIN, M.D.

AND

FRANCIS M. MASSIE, M.D.

OF LEXINGTON, KY.

It is obvious that tuberculosis of the gall-bladder is a rare condition when a study of the literature reveals only fifteen reported cases. We think that it is worthy of note that this condition is not mentioned in that comprehensive work, *Gallenwege Chirurgie*, by H. Kehr, published in 1913. Nor have we been able to find any reference to this subject in the American literature for the past twenty-five years, with one exception, to which we refer below. Whether or not the gall-bladder represents the initial tuberculous lesion, or is a secondary point of attack, cannot be determined from the data at hand in most of these cases.

SIMMONDS¹ collected six cases from the German literature in 1908. He fails to note in his article whether or not these cases were thought to be primary tuberculosis of the gall-bladder, nor does he tell us what the authors considered to be the method or route by which the tubercle bacillus gained entry to that organ. He adds a case of his own of a boy, nine months old, dying of acute miliary tuberculosis, in which instance the gall-bladder was believed to be infected from the liver through the bile stream. The mucous membrane of the gall-bladder showed tuberculous ulcerations very similar to those appearing in the urinary bladder in tuberculous nephritis. Simmonds concluded from his own case and his study of the literature that there may be two types of tuberculous cholecystitis. First, a chronic ulcerous cholecystitis, with or without stones, apparently primary or associated with tuberculosis elsewhere in the body, second, an acute tuberculosis of the mucous membrane always secondary, brought by the bile stream from the biliary ducts of the liver, and always a part of a general acute miliary tuberculosis. He thinks the latter type far more frequent in acute miliary tuberculosis than is generally supposed and is unrecognized at autopsy. He mentions that this has been found several times but does not cite cases.

LANCEREAU² reports an autopsy in which he found a caseous mass replacing the gall-bladder in a woman thirty-two years old. Tuberculous granulations were found in the common duct, the spleen and mesenteric glands presented many tubercles and the right branch of the pubis was necrosed. He considers this to be a case of primary tuberculosis of the gall-bladder, the bacillus gaining entry through the ampulla of Vater and ascending along the common and cystic ducts. He states that the gall-bladder lesion is clearly the oldest pathologically of any he found and therefore the disease was primary in this organ. LancerEAU distinguishes tuberculosis of the extra-hepatic biliary canals and gall-bladder from tuberculosis of Glisson's capsule and from disseminated tuberculosis of the liver. The first condition he thinks is always primary and its mode of entry from the intestine. This type bears no relation to age or sex. This author thinks that tuberculous cholecystitis should always be fairly easy to diagnose, but as he writes from the standpoint of the pathologist this conclusion is not of importance to the clinician. Failure to diagnose tuberculosis of the gall-bladder from other forms of chronic cholecystitis seems to us, in most instances, excusable.

In 1910, GALABRLE³ reported two cases of tuberculous cholecystitis, both of which were operated upon by Tedenat with one satisfactory recovery, and one death. Chole-

cystectomy was performed in both instances. In the first case the patient was a woman, thirty-three years old, who had had good health until four years before operation. During this time she noticed dull pains in the right hypochondrium with occasional knife-like pains in the same region and in the right flank. These pains were especially noticeable immediately after eating. Pain had been practically constant for eight months. Six months previous to operation she noticed a tumor at the right costal margin. She showed at the time of operation habitual malaise, emaciation and occasional vomiting, but no jaundice, and no cough. Temperature was 100.4 to 101.4, there was a harsh expiration at the left apex and a few dry rales on deep inspiration. Operation revealed a gall-bladder adherent to the hepatic flexure of the colon and to the pylorus. The adhesions showed granulations grayish in color with yellow points. The gall-bladder was hard, its walls greatly thickened and indented, and it was about the size of an adult hand. It contained black viscous matter and two large black stones. There were interstitial nodules the size of a grain of corn in its wall, which on gross section showed dry caseous foci of a puriform, yellowish, thickened substance. The specimen was not examined microscopically, but, macroscopically there was no doubt as to the tuberculous character. The gall-bladder was removed and the abdomen drained. This patient made a good recovery, the wound healed without fistula, and the patient was dismissed on the thirty-fifth post-operative day. She was well and had no symptoms when seen six years later.

Galabrec's second case was a woman, thirty-nine years old who had never been seriously ill until her present illness. One month prior to operation she lost appetite and strength rapidly and had continuous sharp pain in the right side increased a few minutes after eating. An upper right side abdominal tumor was so large and extended so far posteriorly that she was operated upon by Iedenat with a diagnosis of kidney tumor. Posterior incision was made and a normal kidney was found. Upper right rectus incision was made and a tumor found extending from the liver to the right iliac fossa. This tumefied gall-bladder contained one perforating stone, 50 cc of pus, and grayish-yellow adhesions. The wall was one inch thick. It was removed and the abdomen drained at closure. The patient died on the third day. Autopsy was not permitted. Histologically the wall showed many tubercles and tubercle bacilli.

A LATRONCHE⁴ collected four more cases in 1911 and adds one of his own. All of these cases were in women between forty-one and forty-nine years of age. Four of them showed pain as a constant sign. Four showed a definite tumor on examination, only one had jaundice, and vomiting was not a pronounced symptom in any. Two of these were treated by cholecystectomy (Biaquchaye, Fedenat) of which one recovered (Biaquchaye), and one died (Fedenat). Three cases were treated by cholecystostomy (Riedel, Czerny, Latronche) and all recovered, two with fistula and one without (Czerny). This latter was cauterized at operation with strong zinc chloride solution. Stones were found in all five cases. The gall-bladder was in every case found to be greatly thickened, and contained thick cheesy pus. In only two of these cases was a histological examination made (Biaquchaye, Latronche). In only one, the author's, was an attempt made to show the relation of the gall-bladder to other tuberculous lesions. In his case there was a definite tuberculous peritonitis, and histological section showed tubercles in the wall of the gall-bladder extending from the serosa inward, from which he concludes that the bacillus was carried by the peritoneal lymphatics and by contiguity to the gall-bladder. Our case was as follows:

RANKIN CASE NOW REPORTED—July 12, 1921. Negress, thirty-eight years old, complains of pain and a mass in the right upper quadrant of the abdomen.

Past History—Well as a child, pulmonary tuberculosis seven years ago. Took "the cure" for two years and thinks she made a complete recovery.

Present Illness—Began about five years ago with persistent dull pain in the right hypochondrium. She had some food disturbance evidenced by increase of pain soon

after eating At first the pain came on at night For the past two years symptoms have greatly increased and the pain has occasionally radiated to the back on the right side For past two weeks has been very sore over gall-bladder and has noticed a tumor She has had some afternoon temperature, no loss of weight, no cough, expectoration, hæmoptysis or night sweats

Physical Examination—Well-developed and nourished negress, thirty-eight years of age, does not look acutely or chronically ill, no anæmia, no jaundice of scleræ Heart and lungs negative Abdomen somewhat distended, muscles tightened Mass in epigastrium and right hypochondrium which is fixed and very tender Vaginal examination negative Temperature 99, pulse 88, respiration 20 White blood-cells 5000, neutrophils 70 per cent Urine negative

Diagnosis—Perforated ulcer of the duodenum with abscess formation

Operation by Dr W Barrow, July 13, 1921 Right rectus incision from costal margin to two inches below umbilicus Large mass adherent to liver and small intestine Adhesions separated with free oozing Large mass found to be gall-bladder, adherent to under-surface of liver with extension into liver Gall-bladder opened, walls about three-quarters of an inch thick Cavity contained caseous material but no stones A portion of the wall was removed for diagnosis and rubber tube placed in the gall-bladder with three gauze strips next to the under surface Layer closure

The patient left the hospital after an uneventful convalescence The wound healed without fistula.

Pathological Examination—July 13, 1921 Macroscopic The specimen consists of a small piece of tissue and caseous material removed from the gall-bladder Microscopic Sections from the gall-bladder show the wall to be greatly thickened due to an excess of hyaline connective tissue It is densely infiltrated with lymphocytes and plasma cells There are a number of areas of necrosis surrounded by endotheloid and lymphoid cells with a few giant cells One surface shows a few cells that resemble liver cells Sections from the caseous material show it to be a granular material with no formed elements

Diagnosis—Tuberculous cholecystitis

August 20, 1925, this woman returned for observation She went back to house work in September, 1921, and has progressed satisfactorily until June, 1925, when her abdomen began to swell She notices now shortness of breath on exertion and palpitation Feet and ankles swell at times Physical examination Heart and lungs negative Abdomen Scar over gall-bladder area, abdomen is prominent and contains fluid, shifting dullness most prominent below navel Pelvic examination unsatisfactory, perineum and cervix O K Fundus and adnexa not felt Impression Tuberculous peritonitis

August 20, 1925 X-ray of chest for tuberculosis, negative

August 24, 1925 Operation (Rankin) Upper right rectus incision through old scar There was quite a lot of free fluid in the abdomen The peritoneum, pelvis, broad ligaments and serosa of the bowel were studded with tubercles The right upper abdomen contained densely adherent masses of viscera in the neighborhood of the gall-bladder and it was with difficulty that separation was made down to this organ There was a small, thickened, nodular gall-bladder All of the fluid was evacuated and the abdomen was closed without drainage

Pathological Report—Macroscopic examination The specimen consists of a small piece of tissue from the peritoneum

Microscopic Examination—The sections show rather loose œdematous connective tissue with no evidence of acute inflammation

September 4, 1925 Convalescence uneventful, all sutures out, wound healed by primary union This patient was advised to consult her home doctor for paracentesis and to return for X-ray treatment

December 4, 1925 Patient returns for X-ray treatment She has had seven paracenteses since operation, was "tapped" four days ago, but abdomen is distended

PRIMARY TUBERCULOSIS OF THE GALL-BLADDER

Treatment K V 190, M A 5 Distance 50 cm Filter $\frac{1}{2}$ cm 1 al Time 25 minutes Area 25x25 cm Location—anterior abdomen

December 5, 1925 Same treatment

January 18, 1926 Some nausea and vomiting after second half of previous treatment General condition improved Eating and sleeping better Has been "tapped" once since last treatment Treatment same

January 25, 1926 Nausea and vomiting following treatment a week ago Feeling O K now Length of treatment reduced five minutes

March 9, 1926 Patient had "flu" in February, in bed two weeks Feeling fairly well again Slight cough persists Abdomen soft, little or no fluid Was "tapped" a month ago and only a few ounces obtained

March 9, 1926 Twenty-five minutes treatment March 11, 1926 Twenty minutes' treatment

We do not think that laparotomy in August 1925, was an important factor in the great improvement this patient has shown We are rather inclined to the opinion that the X-ray treatments should be given the credit, though this method of treatment has only occasionally been of material benefit in tuberculous peritonitis Of course, the case is too recent to form conclusions in regard to any therapeutic method

This is too short a series and the details in all but a few cases are too meagre to draw any satisfactory conclusions, but there are some similarities and differences in those cases in which we have more detailed accounts which warrant emphasis in a brief discussion The rarity of a tuberculous lesion in the gall-bladder, even in acute general tuberculosis, may be due either to failure of the pathologist to recognize the condition, or to a special resistance of this organ to the tubercle bacillus We are rather inclined to the latter opinion, because it has been shown by Hanot and Létienne⁵ that the cystic bile of patients dying from tuberculosis failed to show tubercle bacilli in all but one case And the work of Seigent⁶ shows that tubercle bacilli flourish in the bile of guinea-pigs and dogs but do not produce lesions of the gall-bladder unless this organ has been injured, or the common duct has been injured or ligated The presence of stones in eleven out of sixteen cases and chronic disease in four,¹ we believe a significant factor in lowering the gall-bladder resistance There is no report to show the presence of tubercle bacilli in the stones themselves, and it is extremely doubtful that they can be the primary cause for lithiasis, which is assumed to be the case for the typhoid and colon bacilli at times Is it possible that the fat-splitting and fat-soluble properties of the bile and pancreatic fluid are factors in this resistance, possibly attacking the waxy coat of the bacillus itself?

The mode of entry of the bacillus into the gall-bladder is in most cases purely a matter of conjecture It may be brought by the blood from a distant focus by the hepatic artery or portal vein If carried through the hepatic artery the bacillus may infect the gall-bladder directly, or secondarily through the liver, being brought to the gall-bladder in the bile after the hepatic biliary ducts have become involved It may ascend from the intestine directly through the bile duct, though this is hard to understand in the case of a non-

* In Lancereau's case the gall-bladder was completely caseous, which made histological determination of its structure and type of inflammation impossible

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RETROPERITONEAL TUBERCULOUS LYMPHADENITIS¹

By I S RAVDIN, M D

OF PHILADELPHIA, PA

FROM THE SURGICAL DIVISION B, (DR GEORGE F MULLER) UNIVERSITY HOSPITAL

ONE of the earliest cases in which tuberculous ileo-cæcal glands were found at operation and removed was reported in 1900 by the late Maurice Richardson of Boston before the American Surgical Association. The operation had been performed in 1895. At the same meeting, J W Elliott presented a similar case successfully operated on a year previous. At about the same time, Marchant² also described the condition. Since then this disease has been adequately discussed. A review of the literature, however, discloses only isolated reports of primary invasion of the retroperitoneal lymph-nodes. Although the primary retroperitoneal type of infection probably does not occur as frequently as the mesenteric type, it must occur with sufficient frequency to make it a definite entity.

CASE REPORTS—CASE I—J L, age forty-three. Admitted to the surgical service of the University Hospital, March 7, 1923. Pre-operative diagnosis—retroperitoneal sarcoma.

Chief Complaint—Pain and pulsation in the abdomen.

History of Present Illness—Nine months ago the patient began to have a dull pain in the epigastrium and left hypochondrium. He could not eat very large meals without discomfort. He was distressed with considerable flatulence, belching and regurgitation. These were somewhat relieved by hot water and soda. He has vomited several times in the last nine months. Appetite has been poor and he has lost weight. Since January he has noticed a hardness in the upper abdomen.

Physical Examination—B P 105/70. Rather poorly nourished male. Physical examination was negative except for a soft systolic murmur at the apex of the heart. On palpation of the abdomen there was a hard, nodular mass in the epigastrium extending to both the right and left of the midline. Rectal examination was negative.

Red blood cells, 4,280,000, *white blood cells*, 9600. *Wassermann*, negative.

Gastric X-ray—Stomach, extragastric tumor to the left of the midline at the level with the greater curvature when lying down and widening out the duodenal loop. No direct connection with the stomach. Six-hour gastric residue. Tumor is probably pancreatic or retroperitoneal. Duodenum—negative for ulcer. Colon—good position. Transverse colon below mass and no connection, stasis even after daily movements.

Operation by Doctor Muller—Gas-ether anæsthesia. Right rectus incision. Peritoneum opened. No masses visible. The liver was apparently normal. Spleen enlarged by one-third its size. Palpation disclosed a rather freely movable mass extending along the vertebral column and aorta and up under the lesser omental cavity. It pushed forward the mesentery of the duodenum. Conglomerate and discrete nodules were both present. One specimen from the base of the mesentery of the jejunum and one from the base of the mesentery of the transverse colon were removed for biopsy. Hæmostasis, wound closure, tier suture, no drainage.

Pathological Report—Retroperitoneal tuberculous lymphadenitis (Fig 1).

The patient made an uneventful recovery. During his convalescence he was treated

¹ Read before the Philadelphia Academy of Surgery, December, 1925.

with deep Rontgen therapy by Dr Henry Pancoast. He was discharged on April 11 in excellent condition, having gained weight and the mass being much smaller in size.

At the present time he is entirely well, no abdominal mass can be palpated, he has gained considerably in weight and he is symptom-free.

CASE II—H M, age twenty-three. Admitted to the University Hospital, March 10, 1925. Chief complaint, pain in the abdomen.

History of Present Illness—Patient has suffered with dull abdominal pain located in the epigastrium for several months. There has been no nausea or vomiting, fever or bowel disturbance. Yesterday, the pain became more acute and there was slight elevation

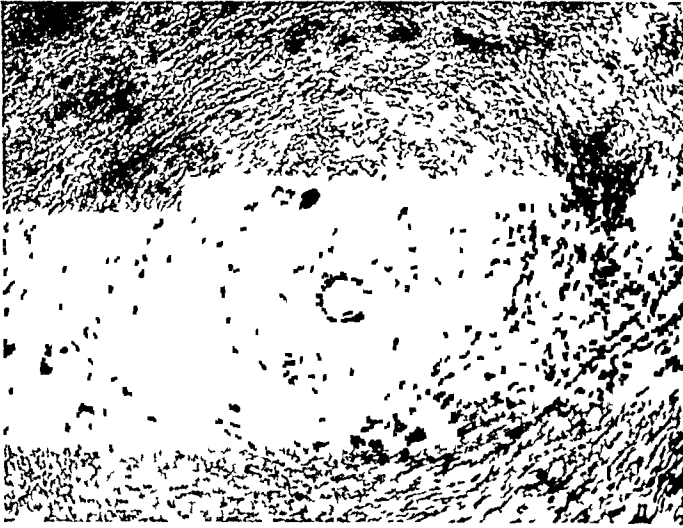


FIG 1—Microphotograph of specimen removed from Case I

of temperature. On examination by her family doctor a mass was felt in the upper abdomen to the left of the median line and she was referred to the hospital. Her family history is somewhat significant, the mother and father both having died of pulmonary tuberculosis.

Physical Examination—Temperature 99.2°, white blood cells 7800. Patient is an undernourished, anæmic looking young female who does not seem acutely ill. Physical examination is negative throughout, except for a mass in the upper

abdomen in the region of the epigastrium, which is about 3 cm in diameter. This mass is slightly tender to palpation. No other masses are palpable in the abdomen.

Operation by Doctor Ravdin—Gas-ether anaesthesia. Left rectus incision. When the peritoneal cavity was opened a retroperitoneal mass was found which was large enough to have partly separated the base of the mesentery of the upper jejunum and the transverse colon. The mass was exposed. There was marked fluctuation and at one point the abscess appeared ready to perforate. With the exploring finger several ounces of pus were evacuated, the cavity swabbed out with iodine and one cigarette drain and one rubber tube inserted into the abscess cavity. The upper extremity of the mass was still hard and several enlarged glands extending along the aorta were palpable. A piece of the wall of the abscess was excised for biopsy. Hemostasis, wound closure, tier suture, around drainage.

Pathological Report—Chronic inflammatory tissue, probably tuberculous.

The patient made an uneventful operative recovery. Before discharge from the hospital she was treated with deep Rontgen therapy and has had a number of treatments since that time.

At the present time she is perfectly well, symptom-free and has gained nearly twenty pounds in weight.

Anatomical Considerations—The explanation for the predominance of the mesenteric tuberculous lymph-gland is probably anatomical. In the majority of these cases the glands are found in the ileo-cæcal mesentery. It seems that anatomical and physiological conditions predestine the site of the infection. The lymphatics of the terminal ileum, cæcum and appendix form a system which seems separate and distinct from that of the remaining intestinal tract. They follow a course from right to left and upward, with the

ileo-cæcal region as a base, and empty into the receptaculum chyli opposite the second lumbar vertebra

The apparent physiological reason for infection at this site as given by Corner² lies in the comparative stasis of the products of digestion in a mildly alkaline medium at this site, a condition which he thinks favors the passage of tubercle bacilli through the intact mucous membrane of the bowel. The microorganisms in the small bowel flourish and multiply during the pause of the fecal current in the cæcum. Thus there are three physiological reasons why the lymphatic glands in this region are most frequently infected: the delay in the passage of food, the presence of organisms possessing a maximum infectivity and the presence of inflammation.

In other portions of the small bowel the lymph drainage goes to the glands nearest to it, that is, the juxta-intestinal group and those situated around the primary branches of the superior mesenteric artery. These lie in the peritoneal folds of the mesentery. The juxta-intestinal group lie close to the intestinal insertion of the mesentery. These glands are small in size and are rarely affected. The second group, situated along the primary branches of the superior mesenteric artery and its first anastomotic arcade, is looked upon as the true regional glands of the jejunum and proximal ileum.

Another group of glands found on the posterior wall of the abdomen receives its afferents from a widely divergent area. The glands receive lymph partly direct, and partly through efferents from the glands in the peritoneal folds. A number of these posterior glands are found around the trunk of the superior mesenteric artery. These are not particularly associated with the small intestine, but receive lymphatics from a portion of the ascending colon, the hepatic flexure, the right half of the transverse colon, the duodenum and the stomach.

Origin of the Infection—This latter group may become infected secondary to infection of the glands in the peritoneal folds, or by direct drainage from that portion of the gastro-intestinal tract which sends afferents to it, or, as occasionally occurs in cancer or sepsis, these distant glands may presumably become infected while glands nearer to the source of the infection remain apparently untouched. For some unexplained reason in such cases the glands closer to the source of infection apparently are more resistant to the organisms even though they are closer to the site of septic invasion.

It is not necessary for the tubercle bacillus to cause a lesion in the intestinal mucosa previous to its entrance into the lymph-glands of the mesentery or retroperitoneal tissues. Upon this point most authors are agreed. Carson,³ however, believes that the infection occurs through some breach in the intestinal mucous membrane, and that before the bacillus can gain a foothold in the glands some preexisting influence such as sepsis must have lowered the resisting power of the gland.

Frequency—That the condition is much more frequent than is generally believed can be shown from the autopsy findings in any large hospital, where

both the active and healed lesion can be frequently demonstrated. Risely,⁴ in a report of 30 cases operated on at the Massachusetts General Hospital for some more or less acute abdominal condition, and in which definite mesenteric or retroperitoneal nodes were found at operation, found that in three instances the glands were entirely retroperitoneal. The explanation of the apparent rarity of the disease as evidenced from case reports, lies in the fact that unless the invasion becomes widespread or unless complications ensue, the symptoms of the disease are so elusive and point so indefinitely to any particular region that they are disregarded and no accurate diagnosis is made.

Course of the Disease—The cases here reported present two stages of the disease in which a clinical diagnosis might be made. The first case illustrates an earlier stage of the process. It represents probably the earliest period at which the surgeon would see the patient. In this case simple inflammatory changes were evident in the periphery of the mass with the appearance of hyperplasia of the lymphoid tissue. The connective tissue had increased markedly, the reticular tissue being dense and fibrous. The trabeculae and capsule were thickened. The tubercles themselves instead of rapidly undergoing caseous degeneration had become partly fibrous and the hyperplastic inflammatory reaction at the periphery of the nodes had resulted in the formation of a dense, conglomerate, nodular mass.

The second case represents a more advanced stage of the disease or at least one in which fibrosis and hyalinization did not occur to an extent sufficient to limit caseous degeneration. It is in this type of case that the peritoneum is more apt to become involved. Caseation, with possible secondary infection and suppuration, in this patient had spread so as to involve nearly the entire mass, only parts of the periphery still remaining somewhat firm. In mesenteric lymphadenitis suppuration is rarely observed and there is no reason to suppose that it should be any more frequent in the retroperitoneal type.

In the third stage of the disease calcification presumably occurs in a manner similar to that which takes place in the mesenteric glands. It is probable that the calcified retroperitoneal nodes observed by the roentgenologist represent this stage of the disease. It is unlikely, however, that large retroperitoneal masses, the result of widespread lymph-gland disease, ever undergo calcification.

Age Incidence—It is interesting to note that while tuberculous mesenteric lymphadenitis is more usually a disease of childhood, both of these cases occurred in adults. The cases of Tyrode,⁵ and Lynch⁶ also occurred in individuals past twenty years of age. It may be that in the adult the regional glands have undergone sufficient fibrosis from repeated septic infection to render them resistive and that the organisms travel further along the lymph passages to reach fertile soil.

Symptoms and Diagnosis—Unfortunately, the diagnosis of this disease is very difficult and in many cases practically impossible, as it apparently follows no definite symptom complex. In 65 cases in which one or more

RETROPERITONEAL TUBERCULOUS LYMPHANGITIS

retroperitoneal or mesenteric healed or active tuberculous glands were found at autopsy at the Massachusetts General Hospital,⁴ the clinical record was reviewed, especially from the point of view of the past history, previous health, and attacks of abdominal pain. None of these 65 cases had anything in its past history to suggest the disease. Thus, at least early in the disease no symptoms referable to the condition may be present.

The patients which are here reported had sufficiently large masses to be palpable. They were undernourished and appeared subnormal as to strength and endurance. They were anæmic and listless. One had a bad heritage for tuberculosis, but in neither was any other tuberculous lesion demonstrable. The appetite was poor. Constipation was not a major symptom, but both complained of flatulence. The chief complaint in both instances was pain, dull and lasting, confined to the upper abdomen, but not pointing definitely to any abdominal organ. The pain was diffuse and from the anatomical distribution of the disease in these cases it might have been due to encroachment on the solar plexus.

It would seem nearly hopeless therefore to diagnose the condition before operation, and even then in those cases in which caseation has not occurred the true diagnosis without biopsy may be overlooked. This is especially so since in the cases of primary infection of the retroperitoneal glands mesenteric enlargement is not to be found. It is cases of this type which this paper considers. Undoubtedly, many of these patients are diagnosed as having retroperitoneal lympho-sarcoma. It is therefore advisable wherever possible to remove some tissue for examination, for only microscopic examination of the excised tissue will reveal the benign and curable nature of the disease.

Treatment—Both of these cases have done well under good hygiene and X-ray treatment. It is likely that in the early stages good hygiene alone will cause subsidence and cure. In all cases it is important to increase the normal vital resisting forces of the body. Removal of the nodes in those cases where this is feasible should be done, but it is unwise to subject the patient to the risk entailed when the blood supply to the viscera is liable to be compromised.

It is important to do a biopsy in any case where doubt exists since the X-ray treatment for retroperitoneal sarcoma is different from that of retroperitoneal tuberculosis. In the first instance the dosage is intensive, while in the latter it is mild, and intensive X-ray treatment in the cases of retroperitoneal tuberculosis will not give favorable results.

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MESENTERIC LYMPHADENITIS*

By ABRAHAM O WILENSKY, M D

AND

LEO J HAHN, M D

of New York, N Y

IN 1920, one of us (Wilensky) ⁹ called attention to a group of cases in which an acute inflammatory process found its main seat of development in the mesenteric glands grouped in the angle of junction of the ileum and ascending colon. Attention was called to this syndrome in view of the comparative frequency with which it occurred, in view of the equal frequency with which the condition was confounded with attacks of acute inflammation in the appendix, and with the frequency with which these adenopathies were subjected to unnecessary operation because of the mistaken diagnosis of acute appendicitis.

The present communication is an elaboration of this thesis and is based upon a more abundant experience obtained since then. In the intervening time a number of communications have appeared bearing directly on this subject, but no thorough study has been so far reported.

The literature is curiously sparse of references to simple mesenteric lymphadenitis. Most ^{1,2,3,4,5,6,7} of the papers on this subject consider only the tuberculous variety or assume that all of the cases are superimposed on the basis of a tuberculous infection. The more important papers follow.

1 STRUHLERS,¹⁰ in 1921, reported four cases three of which were of the tuberculous variety. His records show that he came upon twenty-two cases of mesenteric lymphadenitis in a period of two years during which time he treated one hundred and eighty-seven cases of appendicitis. He believes that the adenitis is due to a tuberculous infection or to a mixed infection on the basis of an old tuberculosis. He also calls attention to the curious but important fact that in appendicitis we do not find a regional adenitis. He believes that tuberculosis of the mesenteric glands is quite common in the young, that the glands retrogress later, and that only when a mixed infection is superimposed do we get the acute attacks of lymphadenitis.

2 HEUSSER,⁸ however, in 1923, brought out the fact that there was no definite basis for considering some of these cases tuberculous. He examined the excised inflamed glands bacteriologically and pathologically and failed to obtain evidence of tuberculosis by culture, guinea pig injection or by the aid of the antiformin method. Neither could he demonstrate bacteriologically the presence of any other organisms. He gives a resume of the clinical findings based on an experience of forty cases, of which twenty-nine were in patients younger than fifteen years. Heusser speculates concerning the possible role of intestinal parasites in the etiology of the syndrome.

3 WILENSKY,⁹ in 1920, described three cases illustrating different types or stages of mesenteric lymphadenitis, and pointed out that some cases of intra-abdominal abscess, formerly ascribed to the appendix, may in reality have resulted from the breaking down

* From the Mount Sinai Hospital, New York, and the Brownsville and East New York Hospital, Brooklyn.

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of the mesenteric nodes, particularly when a fecal discharge had never been noted in the course of subsequent healing of the operative wound

4 WAGNER¹³ (1925) reported a case in which the lymphadenitis had a definite traumatic origin, a blow over the cæcum producing a typhlitis with subsequent local adenitis

5 SIMMERS¹⁵ (1924) points out that Hodgkins disease produces a type of mesenteric lymphadenitis which can be confused with the simple and the tuberculous varieties

6 WAIKER¹⁴ (1922) brings out the importance of keeping in mind the possibility of calcification in the mesenteric nodes which roentgenographically have been misinterpreted as ureteral calculi. This phase of the subject will be discussed in a later paragraph

Anatomy—The general structure of the lymphatic apparatus of the small intestine is comparatively simple and is dependent upon the villus structure of the intestinal mucous membrane. The beginnings of the lymphatic collecting system are found in the blind lacteal vessels which occupy the centre of the villus and which are surrounded by the intravillous venous capillary plexus. Absorption into these primary vessels occurs from the intercellular lymphatic spaces. The primary lacteals unite with one another to form a plexus of vessels which lie in the walls of the intestine.

In addition to this network of lymphatic vessels, the wall of the small intestine is studded with masses of lymphadenoid tissue. In the submucosa of the wall of the terminal ileum, these masses of lymphadenoid tissue assume such large proportions as to be easily recognizable to the naked eye. These form the Peyer's patches of the intestine. The primary lacteals of the intestinal villi and the first succession of the lymphatic network in the intestinal wall both have intimate relationships with these collections of lymphadenoid tissue, which function similarly to discrete lymph-nodes and which are interpolated in the total lymphatic network as the first point of blockage and filtration for the lymphatic flow. The efferent vessels of these collections of lymphadenoid tissue mingle in the primary lymphatic network of the intestinal wall and the resulting accumulated network forms larger trunks which penetrate the walls of the intestine usually in the immediate vicinity of the intestinal veins in the mesenteric border of the gut and thereafter form a vast interconnecting network of larger and larger lymphatic vessels which lie between the opposing layers of the small intestinal mesentery.

Groups of lymphatic glands are situated between the layers of the mesentery and occupy the meshes formed by the profuse anastomoses of the branches of the superior mesenteric artery as they divide and subdivide to supply the small intestine. Collectively the nodes are commonly called the mesenteric glands. They vary in size from a pea to that of a small almond and are proportionately distributed around the periphery of the mesentery with the exception of the immediate neighborhood of the ileum and ileocolic junction in which location the bulk of the glands lie. According to various anatomists the glands vary in number from forty or fifty to one hundred or one hundred and fifty.

The mesenteric lymph-nodes are interpolated in the course of the lymphatic network situated between the leaves of the small intestinal mesentery and form the second point of filtration and blockage in the course of the lymphatic

flow The anatomical relationships between the collections of lymphadenoid tissue in the walls of the terminal ileum and the group of mesenteric glands in the ileocolic angle is especially marked, numerically the two sets are in direct proportion to one another

The direction of flow of the lymphatic current is away from the intestinal wall and its contained Peyer's patches inwards to the mesenteric glands and along the subsequent plexus towards the root of the mesentery and into the thoracic duct This makes up by far the major portion of the flow In very recent years paths of flow have been demonstrated as running from the appendicular region in the retroperitoneal spaces behind the ascending colon towards the gastroduodenal junction and the liver Some of these are undoubtedly derived from communicating lymphatic vessels which make connections between the lymphatic spaces of the mesentery and those of the retroperitoneal retrocolonic space The flow in the latter forms a minority in the total lymphatic circulation In this communication only the first of these paths of flow receives attention

Clinical Notes—Mesenteric lymphadenitis is a syndrome which has in recent years established itself as a definite clinical entity Cases are not infrequently met in which an inflammatory lesion is centred in the lymph-nodes of the mesentery in the general region of the ileocolic junction The clinical picture of the illness is very similar to that of other acute conditions in the lower right abdominal quadrant, and since our attention was attracted to this syndrome we have come to the opinion that mesenteric lymphadenitis is a clinical picture which is not as rare as has heretofore been supposed and we believe that with increased experience and with a wider spread of the knowledge of this symptom complex, this condition will seemingly increase in frequency

The chief characteristics of the clinical picture are as follows

The patients are usually children or young adults The most striking symptom is abdominal pain often beginning in the umbilical region, then shifting to the right lower quadrant There may be nausea, but this need not necessarily be accompanied by vomiting The temperature and pulse rate are elevated A leucocytosis is present A history of earlier attacks of cervical lymphadenitis can sometimes be obtained

The cases which we have observed can be divided into four clinical groups which we have called for convenience

Group I Simple mesenteric lymphadenitis

Group II Suppurative mesenteric lymphadenitis

Group III Tuberculous mesenteric lymphadenitis

Group IV Terminal stage of mesenteric lymphadenitis

Group I Simple Mesenteric Lymphadenitis—In the cases in which the gross pathological picture includes a uniform discrete enlargement of the mesenteric glands without any evidence of suppuration, the affection has an acute onset with chill, or chilliness, and fever ranging to 102 or 103° F, with generalized abdominal pains rapidly becoming localized in the right iliac

fossa, and with moderate symptoms of intestinal disturbance. The degree of toxæmia is often out of proportion to the mildness of the abdominal signs.

Examination of the abdomen usually presents localized tenderness in the right lower quadrant, but little or no rigidity. There may be tonsillar hypertrophy but this does not occur in every case. Examination is otherwise negative.

The character of the physical findings is such as frequently accompanies an early or advanced form of appendiceal inflammation. The clinical picture



FIG. 1.—Microphotograph of a section of a gland removed from the mesentery in a case of simple mesenteric lymphadenitis. Note the dilated lymph spaces.

is so similar to that of acute appendicitis that invariably that assumption has been previously made and operation has been advised under that clinical impression. With increasing knowledge, it has latterly happened upon several occasions that we have entertained suspicions that a lymphadenitis was present. Owing to the nature of things, however, an acute appendicitis could not always be excluded, and with very few exceptions exploration of the abdominal cavity was done as the safer procedure.

With the abdomen open, the appendix is found to be normal. Thorough exploration of the abdominal cavity shows no pathological changes, excepting that the mesenteric lymph-nodes draining the lower ileum, the appendix and the cæcum are enlarged and inflamed. There is no free fluid in the early stages. Under the circumstances the appendix is removed and depending upon all factors a gland is sometimes excised for pathologic examination. In

the non-suppurative type of case, the abdominal cavity can be, and always is closed without any drainage of any kind

The pathology of the glands which have been excised and have been submitted to anatomical diagnosis has always been that of a simple hyperplasia. On one occasion the report read, "Circulatory changes." A microphotograph of one of the sectioned glands is appended (Fig 1)

Following the laparotomy the subjective and objective symptoms disappear fairly promptly and an uneventful convalescence follows. Cases one to four illustrate this simple type of abdominal lymphadenitis.

CASE I—A boy of eleven had an attack of nausea sixteen hours before admission to the hospital. A few hours later, a sharp pain was noted located in the abdomen to the right of the umbilicus. He then began to vomit. The bowels moved after catharsis. The patient had had two similar attacks four and twelve months previously. A tonsillectomy had been performed at the age of two and one-half years. He had had measles. At the time of admission to the hospital, the temperature was 102 and the pulse rate was 112. The physical examination showed an hypertrophied remnant of the left tonsil. The tongue was coated. There was exquisite tenderness and rebound tenderness in the right lower quadrant with rigidity of the overlying abdominal wall. No mass was palpable. Examination was otherwise negative. The blood count showed 14,200 white blood cells with a differential count of 86 per cent polymorphonuclears.

Operation was performed with the diagnosis of acute appendicitis (Doctor Colp). Exploration revealed a normal appendix. There was a moderate amount of clear fluid in the peritoneal cavity. The glands of the mesentery were found to be enlarged to two or three times the normal size, measuring one to three centimetres in diameter, and were soft and pink in color. The appendix and one of the glands were removed, and the abdomen was closed without drainage.

The appendix showed "chronic inflammatory changes," the gland showed "circulatory changes." The culture of the fluid from the abdomen showed an atypical Gram-negative bacillus and the smear was bacteriologically negative.

The post-operative course was uneventful, the temperature became normal on the sixth day and the boy left the hospital on the tenth day.

CASE II—A boy of fifteen was awakened during the night by generalized abdominal pain. He was nauseated but did not vomit. After two days the pain localized in the right lower quadrant. After three more days the pain disappeared. The next night the pain reappeared and the boy was brought to the hospital.

The patient did not appear acutely ill. The temperature and pulse rate were normal. There was no general lymphadenopathy. The abdomen showed only a slight rebound tenderness in the right lower quadrant. Otherwise examination was negative. The pre-operative diagnosis was "subsiding appendicitis."

Operation (Hahn) revealed a normal appendix. A thorough exploration of the abdominal cavity showed only several small inflamed lymph-nodes in the mesentery of the terminal ileum. The appendix and one of the nodes were excised.

The pathologic examination showed "chronic inflammation of the appendix," and "circulatory changes" in the lymph-nodes.

Convalescence was uninterrupted and the patient was discharged from the hospital on the thirteenth day.

CASE III—Following a romp at the seashore a girl of thirteen developed a chill and vomited. Generalized abdominal pains set in and persisted during the preceding night and during the following morning, the vomiting continued. A previous attack of abdominal pain three years before had been diagnosed as appendicitis. She had had scarlet fever, mumps and bronchitis. A tuberculosis of the cervical lymph-glands had been operated

upon three times, but at the time of admission to the hospital, the neck wounds were all healed

On admission she appeared to be acutely ill. She complained of abdominal pain. There was a peculiar yellowish tinge to the skin but no bile was found in the urine. The tonsils were slightly congested and the crypts contained purulent material. The examination of the chest showed no abnormality. There was diffuse abdominal tenderness which was more marked on the right side near the umbilical level. There was no rigidity of the abdominal muscles, and no mass could be palpated. The white blood count was 17,500 with a differential count of 83 per cent polymorphonuclears. It was deemed safer not to defer operation as the presence of an acute appendicitis was thought to be probable, although not certain. The degree of toxæmia and the lack of abdominal signs spoke against appendicitis, but the abdominal pain, vomiting, fever and tenderness urged upon one the necessity for exploration.

Operation (Hahn) revealed a normal appendix. The mesentery contained numerous inflamed lymph-glands one of which was the size of a bean. There was no fluid in the abdominal cavity. The spleen was not enlarged. The other abdominal organs were explored and found normal. The post-operative course was uneventful and the patient went home on the eighth day. The Von Pirquet and Mantoux tests were negative.

CASE IV—A ten year old boy had been having abdominal symptoms for two days prior to his admission to the hospital. The illness began suddenly with generalized abdominal cramps which had a tendency to radiate towards the right iliac fossa, in that locality the pain localized after several hours. A dose of castor oil resulted in numerous bowel evacuations, but there was no blood, mucus or other abnormal content in the stools. There was no vomiting at any time. After a while the pain seemed slightly relieved, but, shortly, it returned again with increased severity. There was some chilliness at the onset and at the time of admission to the hospital the temperature had risen to 102° F.

The boy's abdomen was moderately distended. There was some spasm over the right rectus muscle over its lower half but no real rigidity, and at McBurney's point there was moderately well marked tenderness to pressure. No mass was palpable. The physical examination of the rest of the boy's body showed no abnormal findings with the exception of an hypertrophied condition of both tonsils.

With the diagnosis of an acute appendicitis the abdomen was immediately opened (Wilensky). The appendix showed no macroscopic change. The terminal ileum and caput coli and ascending colon were also normal. The lymph-nodes in the mesentery—the mesenteric glands—draining this part of the alimentary canal, were, however enlarged and varied in size from one-fourth to three-fourths of an inch in their largest diameters. The glands were discrete, there was no periadenitis, and none of the glands showed any foci of liquefaction. One of the glands was excised for microscopic examination and the appendix was removed in the usual manner by ligature, ablation and cauterization of the stump with carbolic acid. The abdominal wound was thereafter closed without any intra-abdominal drainage.

On the day after operation the temperature dropped to normal and all symptoms gradually disappeared thereafter. The subsequent convalescence was uneventful.

Group II Suppurative Mesenteric Lymphadenitis—In other cases of mesenteric lymphadenitis the process has advanced further, more extensive pathological changes are found in the nodes, and suppuration occurs. The clinical picture is very similar to that of the cases in the first group, the difference, if any exists, being one of degree of intensity of the manifestations, and being due to the progression of the illness. The tumefaction is very commonly palpable through the abdominal wall and resembles in all particulars an appendicular abscess. It is impossible to make the differentiation clinically, and under the circumstances an operation is undertaken with the latter diagno-

sis in mind. It makes little difference practically as operation is necessary under either condition.

The differentiation is, of course, made immediately after opening the abdomen when a normal appendix is exposed to view. A little excess of intra-peritoneal fluid is usually present. The physical appearances of the intra-abdominal pathology indicate immediately that suppuration has occurred. The mesenteric glands are matted together into a larger or smaller mass in the midst of which the focus of liquefaction is found. Coils of small intestine may surround and be adherent to the underlying glandular swelling, or the latter may be buried under the adherent mesentery and posterior peritoneum and the overlying intestinal coils may be free. No tubercle formation, or evidence of any other extraordinary etiological cause is demonstrable to the naked eye.

The laboratory data indicate that pathologically and bacteriologically this type of adenitis is the ordinary pyogenic process and that it is not caused by tubercle bacilli or other extraordinary type of infecting organism.

The post-operative course has been stormy in our cases of suppurative mesenteric lymphadenitis. Complications are common. The most common is intestinal obstruction due to adhesions, bands, and resulting compressions and angulations of the intestinal coils. So far none of our own cases has died.

Cases V and VI illustrate the suppurative type of mesenteric lymphadenitis.

CASE V—A young undernourished boy became suddenly ill and the clinical picture resembled very closely that of the preceding patients and had all the ear marks of an attack of acute appendicitis. The symptoms were quite well marked, the fever was high, the patient looked sick, and, in addition to the local abdominal phenomena of spasm, tenderness and distention, an intra-abdominal mass was palpable in the lower abdomen lying partly in the right iliac fossa, and partly extending across the median line to the left. There were no other subjective or objective findings in any other part of the body which might lead one to suspect that the causative lesion was present elsewhere than in the right iliac fossa. The duration of the illness, which was almost a week, and the presence of a mass prompted the assumption that the pathological picture included an inflamed appendix either buried and surrounded in omental adhesions, or surrounded and lying in the wall of an abscess, with this assumption the patient was operated upon immediately (Wilensky). On opening the abdomen the mass was seen to be buried in and under the mesentery and the loops of intestine surrounding this area were everywhere non-adherent and distinct from one another. A rapid survey showed that these as well as the appendix were normal in every way. As a preliminary measure the appendix was removed. A further examination of the mass showed that it consisted of a number of lymph-nodes which had become matted together and had broken down and the presence of pus was demonstrated when during the manipulations the abscess was ruptured into it. It was not possible, nor did it seem advisable to do anything more radical than to institute proper drainage. Accordingly this was done and the abdominal wound was sutured with the exception of the angle through which the drainage apparatus emerged.

The post-operative course was stormy. The temperature persisted for several weeks before it came down to normal levels. The subsequent course of affairs was marked by an attack of acute intestinal obstruction which made its appearance before the abdominal wound had completely healed and for which operation became necessary. The obstruction was due to a broad adhesion in the neighborhood of the old wound and sinus which had produced a sharp angulation of the small intestine. Owing to the precarious condition of the child nothing radical could be done and one had to content oneself with establishing a fecal fistula as close to the point of obstruction as was possible.

The fecal fistula acted most efficiently in relieving the obstruction, and fecal matter continued to discharge from the wound for a number of months. Finally the fistula had to be closed by operation (Wilensky) during which the loop of intestine was freed from its attachments and the opening was closed and inverted in the usual way. This was followed by prompt healing and soon thereafter the patient was discharged from the hospital cured.

CASE VI—A boy of six was seized with an attack of pain in the umbilical region and developed a temperature of 104° F. For the next ten days the latter varied between 99° and 101° F. without any chills. The pain then disappeared. There was no vomiting or diarrhoea. The child had suffered from recurring febrile attacks, characterized by nausea, vomiting and cardiac palpitation which occurred every three or four months and which lasted several days each time. These attacks had been diagnosed "acidosis." No attack of this kind occurred during the past year. A purulent otitis media and a suppurative cervical adenitis had occurred one year previously, tonsillectomy was performed about this time.

On admission to the hospital the patient appeared to be acutely ill. The face was flushed. The tongue was coated. The teeth were in poor condition and the pharynx was slightly congested. There was rigidity of the lower half of the right rectus muscle with direct localized tenderness in the general region of McBurney's point. The rectal examination showed slight tenderness and fulness in the cul-de-sac on the right side. Otherwise the physical examination was negative. A diagnosis of appendicular abscess was made.

Laparotomy (Doctor Colp) revealed a hard firm mass to the mesial side of the cæcum and ascending colon. The mass was covered by omentum and by adherent intestine and contained a thick greenish-yellow odorless pus. The appendix was apparently normal. An appendicectomy was performed. The abscess was drained.

The post-operative course was very stormy. The peritonitis which developed was finally overcome and a residual abscess formed which was evacuated (Hahn) through the original wound. A right upper lobe pneumonia was an additional complication during the fifth week.

The temperature ranged up to 105° F. on the sixth day and did not reach a normal level until the twenty-fourth day. It rose again during the course of the pneumonia during the fifth week and did not reach its final normal level until the eleventh week. Pirquet tests were negative. The pathological examination of the appendix showed inflammation of only the serous coat. This is explainable by the proximity of the appendix to the mesenteric abscess. The pus from the abdominal abscess contained *hæmolytic streptococcus*.

The abscess here was probably due to a mass of mesenteric glands which had broken down and suppurated. The secondary abscesses may have been residual in nature, or may have been repetitions or continuations of the original process in other neighboring glands.

Group III Tuberculous Mesenteric Lymphadenitis—This group includes the cases in which the adenitis is of tuberculous origin. The clinical picture resembles that of the cases in Group II. The physical findings exposed on the operating table need not necessarily include any macroscopic evidence of the tuberculous infection either in the lymph-nodes or in other intra-abdominal viscera and the diagnosis of the latter condition may become apparent at a later date or may be made upon histological examination of tissue excised during the operation. The post-operative course is stormy as in the cases of pyogenic mesenteric lymphadenitis and complications occur. An important complication with tuberculous infection is the tendency for fecal fistula to form and to eventuate in persistent fistulae which require secondary operations.

for closure During such secondary operations, typical tuberculous lesions can be demonstrated The notes of Case VII illustrate this type of case

CASE VII—This was a young girl of sixteen years who, similarly to the previous patients, was admitted to the hospital with the diagnosis of acute appendicitis The history was quite the orthodox one for such an illness and included an acute onset with generalized abdominal pain associated with vomiting and constipation, followed by a fairly rapid subsidence of the general symptoms concomitantly with the localization and intensification of the symptoms—pain, rigidity, and tenderness in the right iliac fossa There was nothing in the family or previous history to cause one to suspect any unusual etiology the patient had never been ill before The general physical examination disclosed no abnormal findings Locally a small mass was palpable which was interpreted as being a much thickened appendix with or without a small accumulation of pus

Operation (Wilensky) was done immediately On opening the abdomen, it was found that the small mass was a group of inflamed glands, buried in the mesentery near the ileocaecal junction, these were matted together and contained a soft area, the appendix, although it lay very near, was not involved in the process Nowhere else in the belly could any other lesion be demonstrated and in the immediate neighborhood there was no indication of a spread of the pathological process either from or to the intestinal tract The appendix was removed An attempt was also made to enucleate the glands, this was only partly successful and during the manipulations the abscess was ruptured and a small quantity of yellowish pus discharged A drain was inserted and the abdominal wound was partially closed

A fecal fistula appeared in the second week, it was rather profuse and continued for more than four months in an unchanged condition The sutured part of the abdominal wound having become infected during the operation, parted later and thereafter the healing proceeded slowly for a number of months until nothing was left but an extremely narrow fistula showing no tendency to close completely, exhausted patience prompted the secondary operation The cause of the failure to heal as well as of the fecal fistula was known to us from the examination of the lymph-node which had been excised at the primary operation

At the secondary exploration the nature of the disease was confirmed as being a tuberculosis of the hypertrophic variety and was located mostly in the caput and ascending colon and to a slight extent in the ileum The sinus led down to a small opening in the bowel The intestinal wall was thickened without, however, having any tubercles visible on its surface, but the general appearance of the gross pathology indicated the tuberculous nature of the infection, even if we had had no previous evidence in the microscopical examination of the lymph-node No other lesions being demonstrable in the adjoining coils of gut, the involved ileocaecal junction was excised and the continuity of the gut was reestablished by a side-to-side suture anastomosis The abdominal wound was closed entirely without any drainage

The convalescence was most uneventful and at the end of the second week the patient left the hospital cured

In the excised specimen the bulk of the lesion lay on the mucosa side Here there were a number of large and small ulcerations with overhanging edges and showing tendencies to assume vertical directions There was no stenosis of the lumen even at the ileocaecal valve

Group IV Terminal Stage of Mesenteric Lymphadenitis—This group includes cases in which the pathology is that of a terminal lesion The symptom complex and the physical findings obtained by examination of the patient are similar in many ways to those of the cases in the previous groups The pathology—that of a calcified lymph-gland—probably has no relation to the

immediate symptoms presented by the patient. The operative findings otherwise approach those of the cases in Group I. The post-operative course is also similar to that of the cases in Group I. The notes of Case VIII illustrate this type of case.

CASE VIII—A young lady of sixteen was brought in to the hospital with the history of having had abdominal pain and of having vomited. The pain was localized to the right lower quadrant. The physical findings were reported to have been tenderness, rigidity and rebound tenderness in the right lower quadrant with tenderness high up on the right rectal wall, but, owing to the unfortunate administration of a dose of morphine before these reported findings could be confirmed, the character of the latter could not be properly evaluated, and under the circumstances exploration was deemed advisable.

Exploration (Hahn) showed that the appendix was covered by a veil of adhesions, but otherwise the organ did not appear to be inflamed. In the mesentery of the lower ileum was a mass the size of an almond, firm and white and evidently a calcified lymph-node. Several similar smaller nodes were felt. Further exploration showed no abnormality in the abdominal cavity. The appendix was removed. Convalescence was uneventful and the patient was discharged from the hospital on the twelfth day.

The pathological examination showed no inflammatory changes in the appendix. Rontgenological studies which were subsequently made showed "on the right side of the abdomen on a level between the third and fourth lumbar vertebrae an irregular dense concretion outside the usual course of the ureter at this point. It is also not of the usual shape of a ureteral calculus" (Doctor Jaches).

Discussion—There can be no doubt that the relationship between the cases described in Groups I and II are very intimate, in fact they are surely but different stages of one and the same pyogenic process, but whereas in the first group the process is so benign that resolution occurs and spontaneous cure follows, in the second type the more virulent infection leads to a more advanced pathological process in which suppuration occurs and operation becomes necessary.

Large intraperitoneal abscesses of unknown origin and etiology are encountered from time to time which are located in the lower right quadrant of the abdominal cavity, the primary lesion is not susceptible of demonstration at operation for the reason that the abscesses are enormously large and in our own experience one felt that any undue exploration would endanger the patient's life by an exposure to the risks of a general peritonitis. These have always been considered as being probably appendicular in origin, but since our attention was attracted to the forms of mesenteric lymphadenitis, we have come to believe that at least some of these abscesses had their origins in suppurating mesenteric lymph-glands. It is quite probable that if the appendix was the cause for the suppurations, the length of time the abscesses had been present would have been more than enough to allow the appendix to slough completely away in at least a large percentage of the cases, this is the supposition which is generally held. And yet it seems very remarkable that at least some of these do not develop some form of fecal fistula during the course of healing, for spontaneous closure of an appendix stump, or of an opening in the caput, is a very stubborn affair and one whose consummation would take many months during which, at some time or other, some indication of

intestinal discharge ought to be visible. The great majority of these have, however, healed very quickly and the healing has been permanent.

The relationship of the cases of tuberculous mesenteric lymphadenitis to the simple cases of Groups I and II are open to speculation. In a certain number, we believe that no connection of any kind exists. In a few the apparent clinical benignity of the simple type of case may very well hide a tuberculous infection, the nature of which cannot be demonstrated because of the simple and easily controlled symptom complex and the absolute lack of any operating room, laboratory or post-mortem room evidence of any kind. Some of the cases in Group II may also primarily be due to a tuberculous infection and the suppuration indicates that a mixed infection with pyogenic organisms has occurred and liquefaction has consequently taken place. From other experiences it is common knowledge that this sequence of events is entirely possible and the eventual permanent healing should not necessarily be accepted as proof of the non-tuberculous nature of the infection but equally so that nature aided by operation has been effective in throwing off all tuberculous tissues and in thus permitting the subsequent healing. On the other hand, in Case VI of Group II, this possibility has been excluded by all available tests.

These three groups of cases parallel lesions of lymph-nodes which are not at all unusual and which are matters of daily occurrence when the glands are situated in other more accessible regions of the body. The affections are especially common in the lymph-nodes of the neck and a lymphadenitis in that locality and of any of the varieties described—simple, suppurative, or tuberculous—calls for no special attention or remark. It is, however, necessary to know that similar pathological lesions do occur in the intra-abdominal lymph-nodes, especially the simple non-tuberculous forms of lymphadenitis.

The terminal lesions described in Group IV are undoubtedly similar to calcifications encountered in lymph-nodes in other parts of the body. Once the calcification is present it frequently becomes impossible to be certain whether the preexisting lesion has been of the tuberculous or of the simple variety. The common teaching has hitherto been that calcification is the terminal healing stage of a tuberculous infection. Whether this is so or whether it is another of the teachings which, having been automatically accepted and repeated, must now be unlearned, seems incapable of demonstration, but there is no reason apparent why calcification may not also be the healing stage of simple suppurative inflammations.

The etiological mechanism of the intra-abdominal adenopathies presents many points of interest. Since the nodes draining the lower ileum, appendix and cæcum are the ones involved, the causative facts must be looked for in these organs. It is possible that tiny ulcerations, abrasions or lacerations of the intestinal mucosa may be present and form the portal of entry for the bacteria but these have never been described, and the opportunity to search for them has not been presented. A history of a preceding gastroenteritis is never present. It is possible that the infection may be transmitted through

some pathological formation, such as a diverticulum at the moment of operation these are unusually not demonstrable and post-mortem evidence is not available

A very important point to decide is the rôle the appendix plays in these forms of mesenteric lymphadenitis, or whether the appendix has no relation to this symptom complex. The available data are as follows

1 Enlargement of the mesenteric lymph-nodes is practically never seen with the ordinary types of acute appendicitis however bad the local pathology may be. When one stops to consider this fact, it seems very remarkable

2 In the cases of mesenteric lymphadenitis which we have seen there have been no pathological changes in the appendix

3 In typhoid fever, which for practical purposes may be considered as a mesenteric lymphadenitis with local lesions in the Peyer's patches and in the mesenteric lymph-nodes, and with the general constitutional disturbances accompanying a bacteraemia, the appendix is regularly not involved in the local pathological changes. The presence of the swelling of Peyer's patches and the enlargement of the mesenteric glands indicate accurately the course of the progression of the infection

In view of these facts it seems correct to assume that appendicular infection does not precede mesenteric lymphadenitis and that there are no clinical relationships between the two

The question of metastatic blood infections does not enter here as lymphatic infections of this kind are invariably those which spread by continuity along the lymphatic channels

There seems to be an exact analogy between the anatomical arrangements and relationships of the cervical lymph-nodes and the lymphatic apparatus of the neck and those of the mesenteric glands, and the intra-abdominal lymphatic apparatus. Each set of glands is in direct relationship with a segment of surface of the alimentary canal. In both the pharynx and in the wall of the terminal ileum, masses of lymphadenoid tissue have become collected which in the neck are the tonsils and in the terminal ileum the Peyer's patches. In either instance the lymphadenoid collections in the wall of the alimentary canal (tonsils, Peyer's patches) form the first point of blockage and filtration of the lymphatic stream, and the cervical and mesenteric lymph-nodes form the second points of blockage and filtration. In either case the lymphatic flow is towards the thoracic duct

In any case it is probable that the lymphadenoid apparatus of the intestinal wall—the Peyer's patches—play a rôle similar to that which the tonsils do in the cervical variety of lymphadenitis. The Peyer's patches, similarly to the tonsils, form the point of entry for the infecting bacteria. There has been no opportunity, thus far, to study the histological character of the lymphadenoid tissue of Peyer's patches in this syndrome but it does not seem unreasonable to assume, and all the available evidence points strongly to the assumption, that similarly to the case in the tonsils, perceptible lesions may or may not be present in the Peyer's patches in the presence of mesenteric lymph-

adenitis Whatever one knows about the mechanism of the entrance of infection through the tonsils undoubtedly applies with equal certainty to the Peyer's patches

Blockage of the infection in the mesenteric glands after the bacteria have passed through the Peyer's patches is exactly similar in mechanism to blockage of the infection in the cervical glands after the bacteria have passed through the tonsils Similar resultant lesions then occur in the mesenteric glands as described and illustrated by the clinical reports in this communication, as would and do occur in the neck As indicated in this report these include the simple and suppurative forms of adenitis and hyperplasia, as well as tuberculous infections and terminal calcifications

It is a curious fact that in some of the patients whom we have observed the abdominal adenitis has seemingly been part of a process in which more than one group of glands have been involved In two of the patients described in this report a cervical adenitis had preceded the inflammation in the abdominal group of glands, in one of these cases the infection was of the tuberculous variety In these two cases there was an interval between the two manifestations In the case of which the clinical notes are herewith given, the process coexisted in both the cervical and mesenteric groups of glands

CASE IX—When the patient was eight months old he began to manifest an abdominal disturbance which occurred in irregular attacks and the chief symptom of which was an abdominal pain of indefinite description This recurred at irregular intervals No definite diagnosis was ever made, but at no time was the diagnosis of appendicitis entertained

At the age of five years the patient again had an attack of this sort The abdominal pain was referred to the umbilical region and the right half of the abdomen, it was not associated with vomiting, and the bowels were constipated At the beginning there was moderate temperature After the first week swelling of the cervical glands occurred and the temperature assumed a remittent type in which the daily variations extended from 96° F to 104° F, this continued for about one week The swelling of the cervical glands then subsided and the temperature fell to normal and remained there for several days Then the abdominal pain returned, the temperature rose again and assumed its previous course and the child looked very ill The patient was seen about this time by one of us (Wilensky) in consultation

At this time the physical examination was entirely negative with the exception of the presence of a tumefaction in the right side of the abdomen about opposite the umbilicus There was some tenderness over the mass but no rigidity The appendicular region was singularly free from any objective signs The examination of the urine showed nothing abnormal, the urine was grossly clear, and there were no abnormal elements in the sediment The white blood count was 14,500, the polymorphonuclear count was fifty per cent The Widal reaction and Von Pirquet test were negative X-ray examination of the genito-urinary tract showed nothing abnormal during the succeeding three days, the tumefaction gradually lessened in size and disappeared, the temperature came down to normal and remained at the normal level, and there was a spontaneous disappearance of all other symptoms

The impression presented was that the abdominal symptoms were due to a lesion in the mesenteric glands similar to that which had been present in the cervical lymph-nodes The disappearance of the abdominal mass was exactly comparable to the disappearance of any swelling in the cervical lymph-nodes

Differential Diagnosis—The differential diagnosis of mesenteric lymphadenitis is a very difficult matter as the discrimination depends very largely upon accumulated experience, often based upon and supported by a knowledge of the relative frequency of occurrence of the various lesions which might be encountered. The chief lesions to be differentiated from abdominal lymphadenitis include

1 Acute appendicitis 2 Acute diverticulitis—either in a Meckel's diverticulum or in any other

Whether or not a tumefaction is present and is palpable through the abdominal wall apparently makes little difference. It is frequently impossible to make the differentiation, as the physical characteristics of terminal pathology were the same in all of the cases.

3 Acute gastroenteritis in children. Undoubtedly some cases of lymphadenitis are discharged from medical care with the diagnosis of gastroenteritis. In the differential diagnosis the presence of diarrhea would be very important.

4 Abdominal grippe. Here again some cases at least of lymphadenitis undoubtedly are mistaken for the milder types of abdominal grippe especially during the times when influenza is epidemic. This differentiation is also a matter of great difficulty.

5 Acute intestinal obstruction of minor grades. The differentiation should be made very easily.

6 Ureteral stone. In cases of terminal calcification of the nodes X-ray picture will show a shadow similar to a ureteral calculus. The symptom complex and physical findings do not aid materially. The diagnosis should be made by the usual urological methods of diagnosis.

7 Typhoid fever. Mild cases of typhoid fever might conceivably be confused with cases of mesenteric lymphadenitis. The differentiation, however, should be easily made.

8 Intestinal parasites. The diagnosis should be easily made after proper examination of the stools.

SUMMARY

1 Mesenteric lymphadenitis is a definite clinical syndrome which is easily mistaken for acute appendicitis, abdominal grippe, gastroenteritis, etc.

2 Mesenteric lymphadenitis may be of the following varieties

I Pyogenic

A Simple

B Suppurative

C Calcified

II Tuberculous

The pyogenic variety is distinct from the tuberculous variety.

3 If a diagnosis can be made, conservative treatment is indicated except in the suppurative type of lymphadenitis.

We thank Doctor A. V. Moschcowitz and Doctor Edwin Beer for the privilege of citing cases from their services in Mt. Sinai Hospital.

The slide for Fig. 1, was kindly furnished by Doctor Mandlebaum.

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PENETRATING BULLET-WOUND OF THORACIC AORTA FOLLOWED BY LODGEMENT OF THE BULLET IN THE FEMORAL ARTERY*

BY G PAUL LAROCHE, M D
OF RICHMOND, VA

IN THE following case there are reasons to believe that the bullet entered the thoracic aorta, caused immediately a large hæmothorax, was carried downward and lodged in the femoral artery. Moreover, there are no reasons to believe that it could have gained entrance to the femoral artery in any other way. There was no evidence of injury to the retroperitoneal structures. The external iliac-femoral artery was thoroughly examined at operation almost to its origin, and there was no wound of this vessel.

CASE No 4937—Colored man, aged thirty-six, May, 1925. While running down stairs to escape attack by the husband of the woman upon whom he was calling, was shot by a pistol bullet from above. The bullet entered the left side of the back just internal to the vertebral border of the scapula. The man continued to run a short distance but his left leg gave way and he was compelled to stop. He was brought to St. Philip Hospital in the ambulance. His chief complaint was of a bullet in his body and of weakness and pain in the left leg.

Examination showed the point of entrance of the bullet as indicated above, positive evidence of a large effusion in the left chest, there was no cough nor expectoration, no more dyspnoea than would have been noted from simple fright, and no displacement of the heart. Abdominal examination was negative. There was great pain and weakness in the left lower extremity, motion and sensation were both present, reflexes were normal, no arterial pulse could be felt in the lower extremity below the groin, the common femoral pulse was normal but terminated abruptly at a point two inches below Poupart's ligament, there was no bruit nor venous distention, no obvious alteration of surface temperature of the two extremities, capillary response on the affected side was extremely sluggish but present.

The man was treated symptomatically and the next morning he had no serious symptoms nor any great pain. X-ray examination at this time showed a large amount of fluid and a small fragment of bullet in the left chest and slight displacement of the heart toward the right. The bullet was located in the soft tissues of the groin, one inch beneath the skin, at a point two inches below Poupart's ligament exactly in the region of the femoral artery. No bone lesion was found in any part of the chest or scapula nor in the region of the hip and pelvis. Blood and urine examination were negative.

The diagnosis was quite obvious, there was a penetrating wound of the chest, a large hæmothorax and a bullet wound blockage of the femoral artery.

His general condition was good and he was treated symptomatically until May 18, twelve days after admission, when the chest cavity was drained of a large quantity of old clotted blood by Dr. B. F. Eckles. Following this the man was soon convalescent and symptom-free, the bullet and arterial pulse cessation were still palpable. At the end of six weeks he was up and about, feeling well save for the pain, cramp and weakness of the leg, and the presence in the region of the femoral vessels of a bullet which in some way, most likely by wounding the vessel, had caused complete blockage of the femoral artery.

For this, operation was performed July 25, 1925. A longitudinal incision was begun

* Reported to the staff of Memorial Hospital, September, 1925.

from a point a little above Poupart's ligament, extending downward over the vessel about four inches. The internal saphenous vein, encountered in the field, was doubly ligated and divided between ligatures. The common femoral vessels were then identified at a point slightly above the location of the bullet, a temporary ligature of tape was put around the beginning of the common femoral artery. This was twisted rather than tied to occlude the blood current because we had learned from experience that a twisted

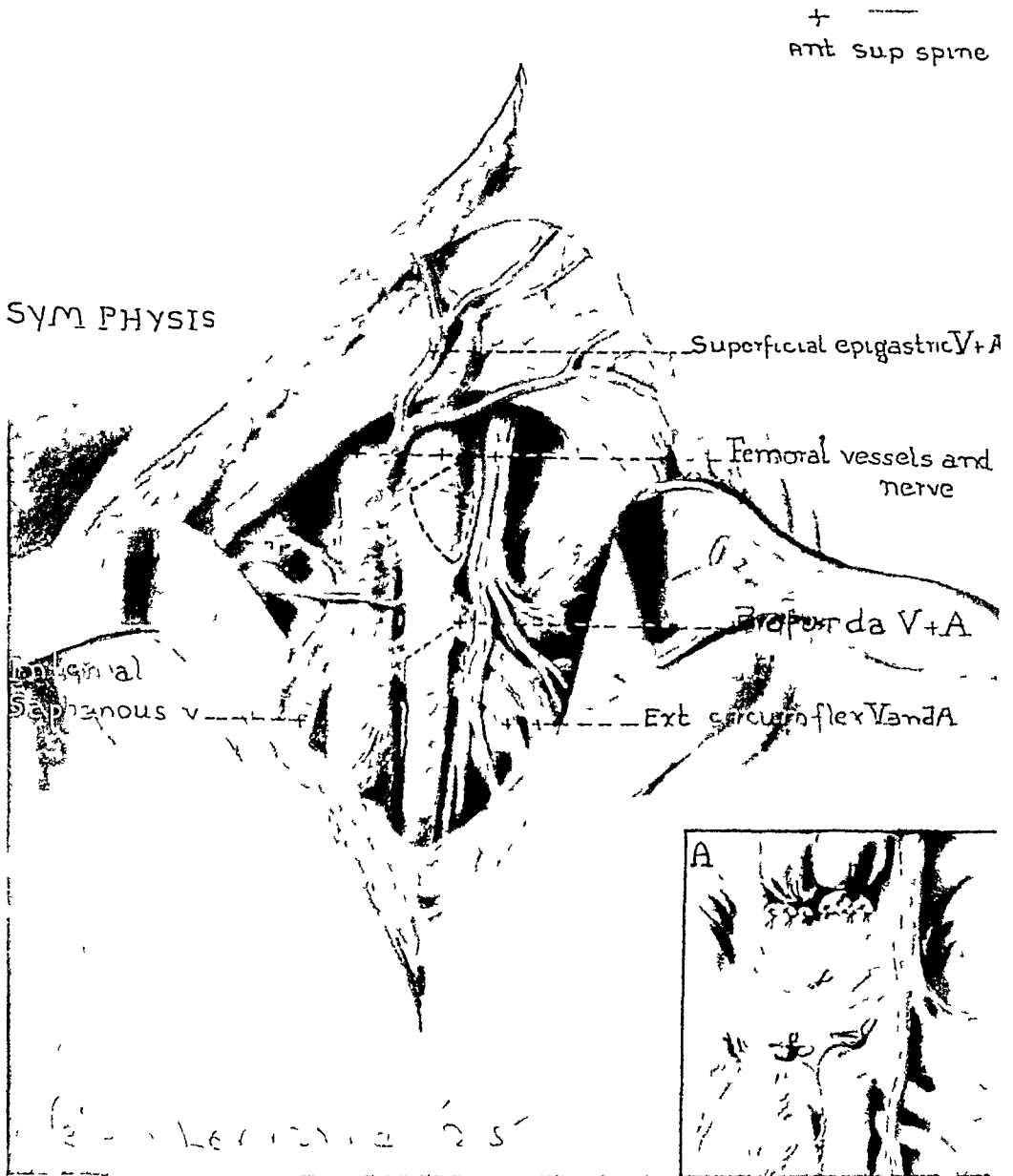


FIG 1 —Bullet lodged in the common femoral artery. Insert shows appearance after excision of vessels

ligature could be more easily removed than one which had been tied. With the circulation thus controlled, the artery and vein were freely exposed downward in search of the lesion. Much to our surprise we found the artery and vein perfectly normal to all external appearance. There was no injury of any kind. The bullet was easily palpated and its position easily seen (Fig 1). Loosening the temporary ligature, pulsation was normal exactly to a point of the location of the bullet, the artery for two inches above was dilated and for three inches below contracted to about half the size of the portion above.

PENETRATING BULLET-WOUND OF THORACIC AORTA

the bullet At this point we searched the parent artery by dissecting it out from its bed as far upward as the peritoneal covering, being careful to avoid injury to the deep epigastric and other branches There was not the slightest appearance of injury, the tissues and vessels being perfectly normal

At this point two questions arose, first—should we incise the artery, remove the bullet and suture the vessel? From a study of the subject on a previous occasion¹ and upon a basis of experience in four other cases in which the femoral artery was excised for bullet wound, I had no hesitancy in excising two inches of the artery in the present case

The other question concerned dealing with the femoral vein Experience and the teachings of Makins² and W S Halsted³ could leave no question of doubt, the accompanying vein, even though perfectly normal, should always be removed whenever for any reason it becomes necessary

to ligate a large artery These two questions being settled, we proceeded at once to excise the artery and vein well above and below the bullet Permanent ligatures of silk were applied, the vessels cut between the ligatures and two inches of the artery containing the bullet, and its accompanying vein were removed intact With the vessels thoroughly ligated above and below the portion to be removed, a surprising phenomena was observed, the vein was seen to bulge, become distended very quickly

and so tightly that the upper ligature blew off and there was a welling up of blood This was seen to come from a tributary on the posterior aspect of the vein through which blood was coming to the ligated portion The tributary was ligated and the field was dry In addition to the single silk ligature around the large vessels, three interrupted fine silk sutures were placed on the proximal ends of the artery and vein as shown in the pictures (Fig 1) The profundus femoris vein also was ligated The profundus femoris artery was not involved, the arterial ligature was placed above this branch The temporary ligature was removed, the wound found to be dry and was closed tightly without drainage The capillary response in the toes at the conclusion of the operation seemed more prompt and conspicuous than before operation Examination of the interior of the artery shows destruction of the intima as illustrated and the danger of thrombosis following simple arteriotomy and suture is made apparent and very real

The patient was kept in bed with the extremity wrapped in blankets and surrounded by hot water bottles for several days His convalescence was uncomplicated, at the end of two weeks he was up and walking around the ward

At no time following operation did he have pain and at no time was his circulation in jeopardy, his capillary response on the injured side was no different from the normal

At no time, either before or following operation, was it possible to detect any arterial pulse below the lesion, the popliteal, tibials and arteries of the foot were examined daily

Since his discharge from the hospital we have not been able to find him It is almost certain that if he had been sick or had any trouble with his leg I would have seen him, for there are only two hospitals here to which he could have gone and I certainly would have been notified

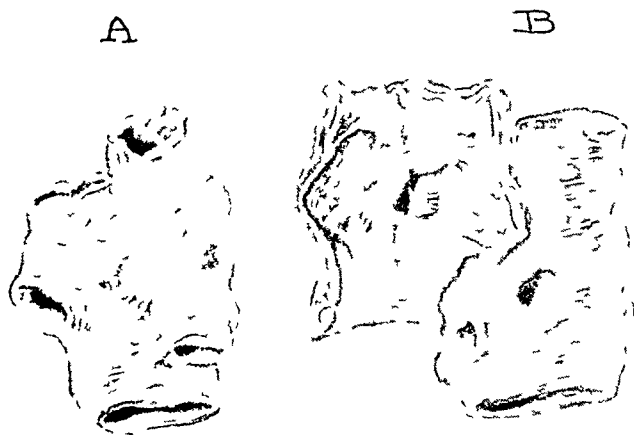


FIG 2—Drawing of formalin specimen of resected femoral artery and vein A viewed from in front B viewed posteriorly with artery cut open to show bullet Note injury to intima

The value of reporting a rare and unique case is greatly enhanced if in its study we can elicit any information which will aid us in the solution of the problems involved in the care of cases of more common occurrence. I have in five patients excised the ilio-femoral artery and vein. In one there was arteriovenous fistula, there were four cases of injury of both vessels and this one of foreign body. In all cases there were perfect results, without disturbance of the circulation in the limb and without return to palpation of arterial pulsation below the point of ligature. A comprehensive study of the subject was published in the *ANNALS OF SURGERY*, March, 1920. Another case was reported in June, 1921, two other cases of injury to the superficial femoral artery and vein not yet reported, and this one of a bullet entering the thoracic aorta and lodged in the femoral artery is the fifth.

Until one is actually shown it seems incredible that a bullet fired from a revolver could enter the thoracic aorta, pass on in the lumen of this vessel and lodge in the common femoral artery. Just exactly this thing is possible, however, and several proven cases are recorded.

Makins² records a case of a patient who sustained a perforated wound of the chest from which, within twenty-four hours four pints of blood were evacuated following which the patient died on the fifth day of streptococcic infection. At autopsy the areolar tissue of the posterior mediastinum was densely infiltrated with blood clots, but no aneurism was present. A slit aperture of entry was found in the descending aorta, and the bullet which had caused this wound was found in the right common iliac artery. There was no reason to assume from the conditions discovered that the patient might not have recovered so far as the aortic injury was concerned. Makins records two other cases showing conclusively that wounds of the thoracic and abdominal aorta by bullets of small calibre or minute particles of shell, may heal spontaneously.

Matas⁴ has collected from literature five cases of migration of bullets and other projectiles entering the heart and aorta and carried by the blood stream to be arrested in arteries of smaller calibre. Four of these entered the heart, two in the common iliac and two in the femoral arteries. Of these, the two cases of lodgement in the common femoral artery were followed by gangrene, and the one common iliac by thrombosis but not by gangrene. There are also recorded a number of remarkable cases of migration of bullets by way of the veins.

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A STUDY IN THE DISINFECTION OF THE HANDS

BY HOWARD LILIENTHAL, M D

AND

JEROME M ZIEGLER, M.D

OF NEW YORK, N Y

IN THE antiseptic technic of operative surgery the disinfection of the hands has always been considered of prime importance. With the introduction of the epoch marked by the employment of rubber gloves, introduced by the late William S. Halsted, a great advance was made, but perfection has not yet been attained, as any one may easily prove for himself by taking cultures systematically of scrapings from the subungual spaces.

An occasional wound infection which can be traced to a torn glove shows that the matter is one upon which the last word has not been spoken and the difference in method encountered in the operating rooms of various hospitals is an indication of at least a certain amount of doubt or dissatisfaction. Moreover, the particularly good results obtained in operations in which no hand, gloved or otherwise, is brought into contact with the field of operation form another evidence of this weak link in the chain of asepsis. Thus the percentage of infections in operations upon the interior of the eyeball such as the extraction of cataract, and the perfection attained by Lane's technic in the open treatment of fractures, still further illustrate the necessity of striving for an ideal in hand disinfection.

The first principle of cleansing the skin is the mechanical one. This has been attempted by scrubbing and the employment of the timing sandglass to insure a sufficiently long period for this procedure. Still, the stiffness of the brush and the vigorousness of the scrubber must also be taken into consideration and here the element of human error enters. No two persons scrub their hands exactly alike and three minutes with one individual may be more efficient than five minutes with another.

I will not speak here of the appearance upon the surface of organisms from the deeper layers of the skin incident to the perspiration which occurs when rubber gloves are worn, for this is something which I believe is impossible to correct, but we should at least start an operation with hands as clean as they can be made.

In the past, attempts to prove the efficacy of mechanical measures have been made by taking cultures from the well-scrubbed hands, either with or without previously contaminating them with living organisms. This method is naturally inaccurate, however, because these cultures have to be taken haphazard from various parts of the skin surface.

It occurred to one of us (Lilienthal) that a test of mechanical cleanliness could be made by covering the hands with an easily visible substance, which

* Read before the New York Surgical Society, March 24, 1926

should not be a dye, and scrubbing until all traces of it had disappeared. We might then assume at least that the dirt from all parts of the hands had been removed so far as the ocular proof could demonstrate.

A mixture of lampblack and oil was selected as a suitable material for this purpose. Smearing the hands, not the arms, the appearance was as if a pair of perfectly fitting black gloves had been put on. Scrubbing now with the usual green soap we soon found that it was impossible to remove all of the lampblack, no matter how long the process was continued (up to twenty minutes). Even after scrubbing with a special brush made to clean the spaces beneath the nails, the telltale mourning band was still apparent. Moreover, bacteriological experiments by one of us (Ziegler) indicated that living organisms were present wherever the lampblack had not been removed. It was also shown that mechanical cleansing had been efficient on the surfaces where the black had been scrubbed away. We have found that organisms will not grow in lampblack and cottonseed oil, although the mixture is not truly bactericidal.

These tests were made not merely from the surface of the skin, but by taking scrapings with a knife previously heated to redness and then permitted to cool. Thus actual masses of the horny epithelium were used in the cultures. This is much more effective than merely touching or scraping the surface with a platinum loop.

From experience with hands soiled by the black machine grease from an automobile engine, certain of the commercial cleansing pastes or mixtures were found to be superior to green soap in their power to eradicate the foreign matter.

There are a number of these substances on the market which do not contain abrasives. The one chosen for our experiments (which we will call Cleanse¹ No. 1 †) is very efficient removing the greater part of the lampblack mixture in a fraction of the time required by green soap, but it was not possible to eradicate every trace of black from the subungual and periungual regions. It has no irritating effect upon the hands and is in this respect distinctly preferable to the green soap. It has some antiseptic power—probably not as great as that of the *sapo viridis*. No accurate comparison was made, however, between the bactericidal potency of the two substances. The wholesale price is about the same. The manufacturers of this substance have refused to divulge its composition. At our request, therefore, Dr. Joseph Reiss in the Department of Chemistry, at Mt. Sinai Hospital (Dr. S. Bookman, Director), made a superficial analysis and reported that the material is a soap containing 85 per cent water, a small amount of free alkali and various volatile oils. The consistency is that of a paste.

Since thorough scrubbing will sterilize the surfaces of the hands except the parts around the nails, we may conclude that ordinary cleansing by this method is efficient and when supplemented by the usual alcohol scrub it may

† Sold under the name of Spce Dee

be assumed that asepsis has been established. With the finger tips, however, a sure method must be employed.

Shortly after the almost universal acceptance of Grossich's technic for sterilizing the skin of the patient, one of us (Lilienthal) adopted, and has employed regularly, the following method for sterilizing the surgeon's fingers.

Before the first operation of the morning or afternoon, the perfectly dry finger tips are immersed in U S P Tincture of Iodine, so as to cover completely the nails and spaces around them up to the terminal phalangeal joint. This is allowed to dry thoroughly. The scrubbing process is then carried out in the usual manner, the hot water removing a great deal of the iodine. At the end of the first operation when the gloves are removed, all traces of the iodine will have disappeared. There is not the slightest skin irritation nor other untoward effect. The reasoning was that if iodine would disinfect the dry skin of the patient, it would manifestly disinfect the fingers of the surgeon.

The procedure proved so convincing that for about ten years many of those who have been associated with Doctor Lilienthal in his hospital service have been employing this method. We have now found by bacteriological tests (Ziegler) that iodine thus employed and permitted to dry for from three to five minutes will completely sterilize the spaces about the nails.

After the hands have once been thoroughly cleansed, it is not necessary to use iodine before succeeding operations unless, through some accident, contamination of the surgeon's hands has occurred when it is advised that the full technic be repeated. Moreover, after clinical tests, we believe that the use of the lampblack mixture is not necessary as a routine, *but that it is most important as a training for those who wish to perfect themselves in operating room technic, both nurses and doctors.* The steps of the procedure are as follows:

- 1 Immerse the dry finger tips in tincture of iodine, immediately removing them and permitting the tincture to dry for five minutes.
- 2 While this is going on the remainder of the hands, including wrists, should be painted with the lampblack mixture up to the limits of the iodine.
- 3 Wash the hands by rubbing with the cleanser without water for about one-half minute.
- 4 Rinse under hot running water.
- 5 Scrub with the cleanser and brush until all traces of lampblack have disappeared, scrubbing the arms as usual at the same time.
- 6 Scrub with alcohol in the usual fashion.

It will then be found that most of the iodine discoloration will have disappeared. The hands may now be dried with sterile towels and the gloves and gown put on.

We recognize that it is difficult to change the habits of surgeons, but we believe that we have demonstrated a method which is superior to those at present in vogue. We would insist that whether the lampblack be used or

not, the employment of tincture of iodine in the disinfection of the spaces around the nails is a most effective and practical method of sterilization and we strongly recommend that it should be practiced as a routine. There need be no fear that the slightest stain or irritation will persist after thorough scrubbing in hot water and after wearing rubber gloves for the duration of the average surgical procedure ‡

Experiments on Scrubbing and Sterilizing the Hands after Applying Lampblack and Cottonseed Oil Mixture with and without Iodine Sterilization of Finger Tips§

(The mixture consists of lampblack and cottonseed oil 50 gms to 200 cc stirred thoroughly until a thick, homogeneous liquid is obtained.)

I Streaked Agar Plates—Incubate for Twenty-four Hours

- 1 Scrapings from under finger nail—*Staphylococcus Albus*
- 2 Finger tips dipped in tincture of iodine
Dried—waited five minutes
Scrapings from under finger nail—sterile
- 3 Scrapings from dorsum of hand—*Staphylococcus Albus*
- 4 Lampblack mixture rubbed on skin
Scrubbed for ten minutes with Cleanser No. 2 (Not No. 1)
Scrapings from dorsum of hand—sterile
Scrapings from surface of finger nail—sterile
Scrapings from thenar eminence—sterile
Scrapings from under finger nail }
No preliminary use of iodine } *Staphylococcus Albus*

II Poured Agar Plates—Incubated Twenty-four Hours

- 1 Scrapings from under finger nail—*Staphylococcus Albus*
- 2 Finger tips dipped in tincture of iodine (7 per cent)
Dried—no waiting
Scrapings from under finger nail—*Staphylococcus Albus*
- 3 Scrapings from back of hand—sterile
- 4 Scrapings from thenar eminence—*Staphylococcus Albus*
- 5 Lampblack mixture rubbed on skin
Scrubbed for five minutes with Cleanser No. 1
Scrapings from back of hand—sterile
Scrapings from thenar eminence—sterile
Scrapings from under finger nail }
No preliminary use of iodine } *Staphylococcus Albus*

III Poured Agar Plates—Incubated for Seventy-two Hours

- 1 Scrapings from under finger nail—*Staphylococcus Albus* (Two colonies)
- 2 Finger tips dipped into tincture of iodine
Dried—waited three minutes
Scrapings from under nail—sterile
- 3 Scrapings from back of hand—*Staphylococcus Albus* (Three colonies)
- 4 Scrapings from thenar eminence—*Staphylococcus Albus* (Four colonies)
- 5 Lampblack mixture rubbed on skin
Scrubbed for five minutes with Cleanser No. 1

‡ It is recognized that certain individuals have an idiosyncrasy which renders the skin sensitive to iodine. This must be extremely rare, however—certainly rarer than the well-known iodoform idiosyncrasy. Obviously anyone suffering in this way will not be able to employ this method.

§ From the Department of Surgical Research, College of Physicians and Surgeons, Columbia University

THE DISINFECTION OF THE HANDS

Scrapings from back of hand—sterile
 Scrapings from thenar eminence—sterile
 Scrapings from hypothenar eminence—sterile

IV *Poured Agar Plates—Incubated Twenty-four Hours*

- 1 Scrapings from under finger nail—*Staphylococcus Albus* (Many colonies, about 150)
- 2 Finger-tips dipped into tincture of iodine
 Dried—waited three minutes
 Scrapings from under finger nail—*Staphylococcus Albus* (Three colonies)
- 3 Scrapings from back of hand—*Staphylococcus Albus*
- 4 Scrapings from thenar eminence—*Staphylococcus Albus*
- 5 Scrapings from hypothenar eminence—*Staphylococcus Albus*
- 6 Lampblack mixture rubbed on skin
 Scrubbed for five minutes with Cleanser No. 1
 Scrapings from back of hand—sterile
 Scrapings from thenar eminence—sterile
 Scrapings from hypothenar eminence—sterile
 Scrapings from under finger nail }
 No preliminary use of iodine } *Staphylococcus Albus* (Two colonies)
 Iodine applied, waited three minutes }
 Scrapings from under finger nail } Sterile

Experiments with Tincture of Iodine—Seven Per Cent

Poured Agar Plates—Incubated for Twenty-four Hours

- No preliminary use of iodine }
 Scrapings from under finger nail } *Staphylococcus Albus*
- Finger tips immersed in tincture of iodine
 Scrapings from under finger nail
 Immediately after immersion—*Staphylococcus Albus*
 After waiting for iodine to dry—*Staphylococcus Albus*
- Fingers dry and waited three minutes } *Staphylococcus Albus* (Obtained occasionally)
- Fingers dry and waited five minutes } Sterile

The above experiments were carried out five times. To obtain sterility the minimum time of waiting when the tips of the fingers were immersed in tincture of iodine solution was three minutes after the iodine had dried. It is better to wait five minutes after the iodine solution dries to be certain of sterility of the finger nails and before applying the lampblack mixture and commencing to scrub.

Experiments with Lampblack and Oil Mixture

I *Cultures from Lampblack and Oil Mixture Standing at Room Temperature for Seven Days*

- 1 In meat extract broth—1 per cent dextrose
 after twenty-four hours and forty-eight hours } Sterile
- 2 In Agar Stab
 after twenty-four hours and forty-eight hours } Sterile

(Above repeated three times)

- II *Cultures from Lampblack and Oil Mixture* } Sterile
Incubated for Seventy-two Hours
- III *Cultures from Lampblack and Oil Mixture*
Standing at Room Temperature for Ten Days
 I Poured Agar Plates
 after twenty-four hours and forty-eight hours } Sterile
- IV *Lampblack Mixture Standing Fourteen Days*
 I Poured Agar Plates
 after twenty-four hours and forty-eight hours } Sterile
- From the above experiments one may deduce that the common organisms do not grow in the lampblack mixture standing exposed at room temperature
- V *Meat Extract Broth—1 Per cent Dextrose 1 cc in 1 cc of Lampblack and Oil Mixture*
 Above mixture shaken well and inoculated with
 B prodigiosus—incubated for twenty-four hours
 B prodigiosus grows readily in above mixture
 (Mixture has no antiseptic qualities)
 (Test repeated three times)
- VI *B Prodigiosus Rubbed on Hand*
 Lampblack and oil mixture applied
 Scrubbed with Cleanser No 1 for five minutes
 Poured Agar Plates—incubated twenty-four hours and forty-eight hours
 Scrapings from palm of hand—sterile
 Scrapings from back of hand—sterile
 (Repeated three times)
- VII *Agar Plate Streaked with B Prodigiosus*
 Cleanser No 1 poured into plate
 Incubated for twenty-four hours and forty-eight hours—No growth of
 B prodigiosus

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY

Stated Meeting Held March 10, 1926

The President, DR WALTON MARTIN, in the Chair

BIRTH FRACTURE OF THE SHAFT OF THE FEMUR, EIGHT YEARS AFTER INJURY

DOCTOR EDWARD D TRUESDELL presented a boy, now nearly nine years of age, who came under his care when three weeks old, having sustained a birth fracture of the left femur. The fracture was situated near the centre of the shaft, as is commonly the case, and the fragments were firmly united in a position of marked anterior angulation. At the present time the leg is one-quarter of an inch short. There are no disabilities of any sort. The examination of the leg is negative, except that upon X-ray examination there is seen to persist a very slight anterior curvature of the upper part of the shaft of the femur. Doctor Truesdell presented lantern slides showing the condition of the fracture when first coming under his care at the age of three weeks, also lantern slides showing the condition of the femur fifteen months after injury—the anterior angulation now being represented by an excessive anterior curvature. Another lantern slide showed the fracture four years after occurrence, with but little diminution of the anterior curvature. X-ray observations made in 1925 and 1926 showed a very remarkable diminution of the anterior curvature, the X-ray made in March of this year showing an almost complete elimination of the deformity.

Doctor Truesdell also presented lantern slides showing a case of birth fracture of the humerus uniting with an outward angular deformity that had eliminated this deformity entirely during the first two years. He stated that the case of birth-fracture of the femur presented was particularly instructive since it changed his idea about these injuries almost completely. Having followed a number of these cases for five or six years, he had come to the conclusion that anterior curvatures of the femur persisted in contrast to the curvatures observed in the humerus, which disappeared uniformly in two years, and this probably because of weight-bearing. However in the case presented an extreme deformity was seen to disappear between the fifth and eighth years of life, showing that, if this case can be regarded as a criterion, while these deformities may persist longer than do the deformities of the humerus, they will eventually clear up even several years after the patient begins to walk. He said that he also believed that similar deformities consequent upon unreduced birth-dislocations of the lower femoral epiphysis might be depended upon to behave in the same way.

CONGENITAL CERVICAL MENINGOCELE EIGHT YEARS AFTER OPERATION

DOCTOR TRUESDELL presented a little girl upon whom he had operated in September, 1916, when one month of age, for the removal of a cervical meningocele. The tumor was about the size of a plum, pedunculated, and was removed by an elliptical incision about the base. The stem, or stalk, of the tumor narrowed down until it passed between the fifth and sixth cervical vertebrae into the spinal canal. No direct communication was dis-

covered with the space surrounding the spinal cord. This sac was ligated and cut away and the wound closed. The patient made an uneventful recovery, and has been well ever since, having developed none of the symptoms so frequently following the removal of meningoceles from other situations.

DOCTOR TRUESDELL also presented a photograph of another child, now eight years of age, on whom he operated in December, 1918, for an identical condition. He also cited a third case, a child of ten years of age, who had come under his care for another condition, who, from the location and appearance of the operative scar and from the mother's history of the case, had had a cervical meningocele.

This patient was presented, and the other two cases cited, to demonstrate the difference in significance and prognosis between cervical meningoceles and meningoceles occurring sub-occipitally or in the lumbar region accompanying spina bifida. The cervical meningoceles would seem to be of merely local significance and compatible with normal development following their removal.

INFLAMMATORY CARCINOMA OF THE FEMALE BREAST

DOCTOR BURTON J. LEE presented three cases of inflammatory carcinoma of the breast. All three were diagnosed as primary and inoperable. These were classified under this heading, both because of the clinical findings and because this type of mammary cancer in most instances warrants such classification.

CASE I—MRS. C. W., white, aged thirty-five, had one miscarriage, no pregnancies. Eight years previous she had a hair follicle infection in the left axilla and two years later an abscess in the left breast, which discharged without surgical intervention. The patient felt she always had a lump in that breast since that time. In July, 1925 a small tumor appeared below the scar in the breast, slight pain developed and she reported to the clinic of the Memorial Hospital, January 11, 1926.

Physical examination at this time showed the left breast occupied in its entirety by an ill-defined tumor. The skin was reddened over most of the breast with a "pig-skin" appearance. The nipple was flattened and the whole breast elevated on the chest wall. One node was present in the left axilla and one in the left supraclavicular region. The chest plate was negative for evidence of intra-thoracic metastasis.

Treatment. Up to the present date the treatment has been high-voltage X-ray with the following set-up:

- 4 milliamperes of current
- 9-inch spark gap
- 25-inch focal distance
- $\frac{1}{2}$ millimetre copper
- 1 millimetre aluminum filtration

Four treatments of 80 minutes each were given, two over the breast anteriorly to include the supraclavicular region, one to the breast laterally and one to the axilla.

This cycle is now being repeated with the same set-up, but the time of the treatment has been reduced from 80 minutes to 60 minutes.

Results. There has been a moderate reduction in the size of the tumor and a slight decrease in the erythema of the skin. The patient was shown as one in the course of treatment. It is probably too early to determine just what could be expected from this therapy.

CASE II—MRS. C. A., aged forty-six, colored. The woman had seven lactations, each of one year's duration without complications. The last was in 1921. In November, 1925, there was some induration above the right

INFLAMMATORY CARCINOMA OF THE FEMALE BREAST

nipple and also about that time the patient had a slight bruise of the breast. Following this the breast swelled, two weeks later, pain developed in the breast and shortly after this a slight cough was noticed. For two weeks prior to her admission to the clinic of the Memorial Hospital, flaxseed poultices had been applied for what was thought to be an inflammatory process. As no improvement was obtained, she was referred to the Memorial Hospital, February 15, 1926.

Physical examination showed a massive inflammatory carcinoma involving the entire right breast infiltrating the skin in all directions. There was beginning extension of the disease to the left breast and the right axilla was filled with a solid mass of nodes. Several nodes were palpable in the right supraclavicular fossa. The axillary nodes were also involved on the left side. Physical examination of the chest revealed fluid at the right base and the chest plate showed intrathoracic involvement on the right side.

Treatment. As this case was too far advanced to warrant intensive therapy and because the patient was in poor physical condition, intermediate dosage X-ray was decided upon. The following set-up of treatment was used:

4 milliamperes of current

10-inch spark gap

15-inch focal distance

5 millimetres of aluminum filtration

Time of treatment, 25 minutes

The breast received two treatments anteriorly. While the lateral breast and axilla were treated for only 15 minutes, a similar set-up was used for the left breast. February 26, 1½ quarts of straw-colored fluid were obtained by thoracentesis of the right chest.

Results. Little palliation has been obtained by the treatment, although it is too early to expect much change. The disease is progressing and the patient's general condition is not as good as when she entered the clinic.

CASE III—MIS C W. This woman was thirty years old at the time of her admission to the Memorial Hospital, June 27, 1922. She had had two lactations, the first in 1908 and the second in 1911, with the duration of two months and fourteen months, respectively. No complications during lactation. There was an indefinite history of trauma. The history of her breast condition at the time of admission was as follows: Two years previously she noticed in the outer portion of the right breast a small lump the size of a pea. The growth had been slow, but because of a recent appearance of redness of the skin and pain she was referred to the breast clinic.

Physical examination showed the right breast larger and heavier than the left, slight nipple retraction and "pig-skinning" above the areola. There was an indefinite tumor fraction in the outer portion of the breast extending up to the axilla. Firm nodes were present in the right axilla and while the right infraclavicular space was more prominent, no definite mass could be palpated. No nodes were present in the right supraclavicular fossa. The left breast and axilla were negative and the chest plate revealed no definite evidence of pulmonary metastasis.

Treatment. The patient received one cycle consisting of four treatments of intermediate dosage X-ray in June, 1922, and in August she received two high-voltage X-ray treatments of 60 minutes each over the right breast. In October and November of the same year three more high-voltage treatments of 60 minutes each were given. The following May no definite tumor process could be palpated. In October, 1923, she became pregnant, and upon consultation a therapeutic abortion was advised and performed. At this time she received two more high-voltage X-ray treatments of 60 minutes each.

Results Until recently only one small, firm node could be palpated in the axilla and at the present time there is no evidence of disease. The chest plate has remained negative and the patient is in excellent general condition.

DOCTOR ALFRED S. TAYLOR mentioned a case similar to the ones presented by Doctor Lee, which he observed twelve years ago. The pathologist who took the gross specimen in the operating room said it was non-malignant because it was encapsulated. The specimen was shown to Doctor Elser, who said it was the most malignant of all tumors, no operation would be of any avail and in three months the patient would be dead. In fact, she was dead in three months. There was seen an extension of the growth to the ribs and the lung. No surgical intervention would seem to be of avail in cases of this type at any stage in their evolution.

DOCTOR JOSEPH WILNER said that about ten years ago he had a case of a young woman referred to him with this condition. An incision had been made in the growth by a competent surgeon for the purpose of diagnosis and in six weeks the patient was dead. He had amputated in suspicious cases without making an incision, for in these cases it is better to remove the growth without biopsy. The breast should be removed rather than endanger the patient's life.

DOCTOR EUGENE H. POOL said that at the present time surgeons are scarcely ready to accept the diagnosis of carcinoma of the breast when a cure is announced without histological evidence of cancer. Doctor Lee had presented a young woman as a three-year cure after radium treatment. It is difficult in seeing this case to picture the healthy youthful skin as the site of carcinoma three years ago. Various arguments have been presented against biopsy in such inflammatory carcinomata. Yet it is of vital importance, as is evident in this case, to know definitely whether or not cancer really existed. This feature outweighs the disadvantage of biopsy and this means of establishing the diagnosis should unquestionably be adopted. With such verification even a single case of this kind would be invaluable. Without such verification the case excites only uncertainty.

DOCTOR NATHAN W. GREEN said that the whole question of carcinoma of the breast might be cleared up from two or three angles with great benefit to the medical profession and to the patient. Early diagnosis of carcinoma is very frequent now, that is, the tentative diagnosis. That puts the case up to the surgeon whether to make a complete positive diagnosis and to do a radical operation, or to try to effect a cure without rendering a positive diagnosis. In some institutions it is the habit to make an excision of the tumor, going wide of it on all sides, and examining a portion of this, wait for a report of the frozen section, if it is reported malignant, take off the breast by the radical operation. In other institutions the habit is not to do a biopsy previous to treatment. It is very important to know when to do one thing and when to do the other. Doctor Lee has had as many cases of carcinoma of the breast at the Memorial as anyone, and there the consensus of

opinion is that in conference of the Staff, one is able to make a diagnosis of carcinoma of the breast without the aid of the microscope, except in very rare instances, the same as a horticulturist can tell whether an evergreen tree is a pine, a spruce or a hemlock, without sectioning the wood. This is especially true of these acute carcinomata where any attempt at excising a specimen would lead through involved tissue and end in disaster. A familiarity with all forms of cancer gives one a caniness that frequently enables one to make a diagnosis without reference to a technical pathologist. But modern critical practice demands a microscopic section. At present the breast service feels competent to state when a case may safely be attacked surgically or whether it is better to treat it by some form of physiotherapy.

DOCTOR LEE said that although no section had been made of this growth, there was no doubt in his mind that the patient had a true carcinoma of the breast. Of all the cases in this group this patient was the only one in which complete regression occurred with the use of X-ray. None of the other cases were successfully treated by radiation. They have been held for two or three years, but this is the only case that has gone for over three and one-half years.

PARTIAL RESECTION OF MANDIBLE WITH RECONSTRUCTION OF CHEEK FOR ANKYLOSIS WITH FACIAL CICATRIX

DOCTOR HUGH AUCHINCLOSS presented a woman, aged eighteen years, single, who January 6, 1906, fifteen years ago, was kicked in the right leg by a horse, and treated in Bellevue Hospital. In the course of her treatment, an incision was made in right leg over upper end of tibia, and later, abscesses and gangrene of right cheek developed and were incised. She was discharged April 30, 1907, after a stay of one year and four months.

September 24, 1907, five months later, she was readmitted to Bellevue Hospital for attention to the scar of her right cheek. An unsuccessful skin-grafting was done and she was discharged after six weeks with cicatricial deformity. Later on she was subjected to the Indian type of pedunculated flap from arm. Mother says patient was at Bellevue about five years in all. Jaw was freely movable but scar was very deforming.

About nine years ago she entered a Brooklyn hospital and submitted to a plastic operation, after which the jaw began closing tighter and tighter. Five years ago she was operated on at Mt Sinai Hospital where the scar was excised and she was provided with a jaw-spreading machine. Improved for a time, but contracture soon became as bad as ever. The teeth in the right upper and lower jaws began to decay and she had repeated infections resulting in chronic bone infection of upper and lower alveolar ridges. These



FIG. 1.—Condition on admission showing inability to open jaws.

infections pointed at the place where the cheek was adherent to the ankylosed jaws

January 21, 1922 An epithelial inlay was attempted by Doctor Dunning



FIG. 2—Condition on admission showing paralysis of facial muscles on right side of mouth and adherence of cheek to alveolar margins of upper and lower jaws

at the Presbyterian Hospital with an effort to free scar tissue, but this was of no material help as it sloughed owing to the chronic infection. For the better part of a year she visited Doctor Dunning, who was able to bring the infection to a quiescent stage with cheek sinus closing. The cheek was a mass of scar cemented to both upper and lower jaws causing ankylosis. There was practically no inside mucous lining to the right cheek. There was no vestibule for the mouth on the right side. As a matter of fact, the cheek on that side was more like a gum attached to the alveolar processes than a cheek. With this view of the deformity, it seemed plausible to leave the old cheek attached to the bone, reconstruct a

new cheek outside of it by grafting a double-faced, pedunculated flap from the shoulder and subsequently cut through the old cheek between upper and lower jaws in the hope that, if incised far enough back, the jaw might be opened.

This operation was done February 28, 1923, suturing the superior and posterior sides of the reduplicated flap to the cheek above and behind after making a right-angle incision in the cheek above and behind the scar tissue. The position was retained by means of a large plaster bandage about the head and shoulders. Thiersch skin grafts from thigh were applied to the denuded shoulder. Ten days later, the flap was cut free. Considerable growth of hair took place on this flap. She had an attack of influenza then, there being an epidemic at the time. This delayed the operative procedures.

Seven weeks later, April 21, 1923, the lower margin of the flap was sutured to the edges of an incision made near the lower margin of the mandible. This left a pouch with the opening toward the mouth.

Eleven weeks after the graft, May 19, 1923, the hinged free edge toward the mouth was incised and sutured to a vertical incision made through the old cheek just outside the commissure of the mouth. This provided an excellent vestibule and the newly constructed cheek allowed a finger to be readily



FIG. 3—Operation February 28, 1923. Suture of posterior and superior edges of pedunculated flap taken from behind her shoulder. This flap is reduplicated; the anterior edge forming the hinge. When attached below and anteriorly it forms a new cheek. Photo taken May 12, 1923, two months and twelve days after operation.

PARTIAL RESECTION OF MANDIBLE

passed between its inner surface and the teeth. The old scar tissue of her original cheek was then freely divided well back to the ascending ramus of the mandible. It was disheartening to find, however, that the jaws could not be separated any more than before. She was sent home June 3, 1923, with a wedge to be used to increase the range of jaw motion. She made very little, if any, progress all summer. A band of scar tissue to the mandible near the mouth edge of the graft was very dense.

September 27, 1923, this scar band was excised and a good sized free epithelial inlay on modelling composition was buried beneath the mucosa alongside the mandible. This improved the size of the vestibule somewhat. It was then considered possible that the masseter and pterygoid muscles were involved in the scar and were the factors maintaining ankylosis.

December 1, 1923, through an incision below mandible, the masseteric and pterygoid attachments were separated from their outer and inner surfaces and some scar tissue in front was removed. Absolutely no improvement resulted. Upon consultation with Doctor Semken, it was agreed that the only thing to do further was to expose and remove the cicatrix thoroughly, no matter how drastic a procedure had to be resorted to, and that the main scar existed about the infected teeth.



FIG 5—Two years and one month after resection

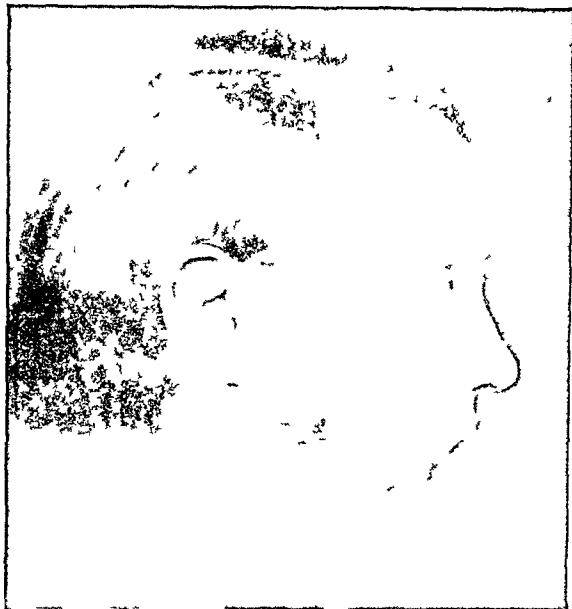


FIG 4—The new cheek has been attached on all sides and effort made by section of masseter and pterygoid muscles to open the jaw without avail. The thirteenth operation on January 7, 1924, resected much scar tissue and a part of the mandible. Photo taken one month later showing ability to open jaw but an opening into the mouth made at the time of the operation. A little mandible shows in the wound.

X-ray plates taken by Doctor Imboden showed no definite evidence of temporo-mandibular ankylosis.

January 7, 1924, nearly a year after the cheek graft, the whole mandible was nested in scar tissue about the lower part of the ascending and posterior part of the horizontal ramus. To free the bone the following operation was carried out. Beginning at the space below the malar bone extending back to the sphenomaxillary fossa and down to the lower margin of the mandible, literally chunks of scar muscle and ligaments were carved away. Not until the mandible was partially resected leaving its inferior margin longer than its alveolar could the jaw be

opened. But when this was done, it was possible to open the jaw for 1.5 cm between the incisors, quite enough for practical purposes. Six badly infected teeth were removed and the wound approximated as well as possible, though

it was impossible to wholly close off the mouth cavity. Bleeding from the internal mammary and venous plexuses about the joint was far less than was expected. At this stage the value of the pedunculated graft was evident. The nutrition of the graft remained good throughout. An attempt to model a double-faced graft into an actual defect in a cheek with the mouth cavity open and with every chance for infection, would have been fraught with difficulty. With the graft already in place before ever opening the mouth, it was possible to dissect it with surprising impunity. Doctor McCaffery wired her teeth together with a cork inserted between them on the left side to temporarily maintain the mandible in proper position. After ten days a wooden wedge was used instead. Then a spring interdental splint.



FIG. 6—Two years and one month after resection.

February 8, 1926, all wounds healed. Can open mouth almost two cm. Doesn't want any cosmetic or plastic operations, at present anyway, and is happy.

The reasons for showing this case are:

- 1 The persistent and inflexible demeanor of scar tissue particularly when chronically infected.
- 2 The method employed by which the old cheek was used for gum and a new cheek created by double-faced graft before opening the mouth cavity.
- 3 That pterygoid and masseter muscles had no part in the ankylosis.
- 4 That resection of a bit of the jaw has been a satisfactory and comfortable procedure in this case where the temporo-mandibular joint had never had any reason to be considered diseased.

INTERSCAPULOTHORACIC AMPUTATION FOR SARCOMA OF ARM

DOCTOR HUGH AUCHINCLOSS presented a colored woman, twenty-eight years of age, who came to the Presbyterian Hospital Out-patient Department, October 8, 1924. In 1920, during her first and only pregnancy, she noted a painless lump in her right axilla, size of a hen's egg, firm, movable, not tender. No temperature. Gradual growth to size of a small cantaloupe at end of second year.

In 1922, she entered St. Luke's Hospital and remained for a week, where she was studied. Radium was advised but refused, and there was question

as to operability After leaving there, there was slow increase in size and more pain Then six to seven months of more rapid progress Beyond a slight prolongation of menses of two months previously, she had considered herself always normal Five years ago, weight 176, now 152 pounds, pulse, 108, blood-pressure, 165/100 Though admitted and advised operation, neither she nor her husband would consider it But she did agree to take X-ray treatments These were given from October, 1924, to July, 1925, forty treatments in all, and she was watched and measured carefully in the Follow-up Clinic While there was marked relief of pain, the effect upon the growth was practically negative

October 28, 1925, she was readmitted to hospital, weak, hardly able to walk, legs oedematous, pale, dyspnoeic, chest wall brawny and tender, arm fungating and inflamed, no definite evidence of metastasis Tumor had been ulcerating for six weeks Calcium deposits were detected in the tumor by X-ray Haemoglobin, 35 per cent, red blood cells, 1,900,000 She was at last willing to submit to anything to save her life

During the three weeks immediately following her admission to hospital, a succession of blood transfusions, five in all, were done, which brought the haemoglobin up to 75 per cent, and the red blood cell count up to 3,920,000

November 23, 1925, five weeks after admission, a right interscapulothoracic amputation was done in the axilla, showed merely hyperplasia Subclavian artery large Veins very large Operated on the twenty-eighth day after admission Up the eleventh day On the sixteenth day walking On the twenty-first day discharged Tumor weighed nineteen and three-quarter pounds without the forearm It had lobes and septa, some of which were calcified and resembled a uterine fibromyoma Muscles great vessels and brachial plexus "wandered into it and were lost" Several axillary nodes were considerably enlarged, but showed no tumor They were merely hyperplastic A thrombosed vein on the surface had canalized Humerus was wholly free, but showed red marrow Microscopically the tumor was made up of spindle cells with many mitoses

Doctor Stout believed it might metastasize locally, but that it was not a malignant growth in the sense of metastasizing in distant parts Its origin was wholly hypothetical He called it a fibro-sarcoma of arm



FIG 7 —Sarcoma of arm four years after onset, one year before operation

The reporter's reasons for showing the case were

1 The four-year local growth of a connective-tissue tumor of the arm to an enormous size, forcing the patient to operation only after a secondary anæmia had reached a degree making it evident to her as well as everyone else that she was about to die

2 That the arm might have been saved had she been operated on earlier

3 That X-ray treatment gave temporary comfort, but nothing else

4 That what may seem inoperable from standpoint of size may be some-

times operated on with comparative ease

5 That repeated transfusions are of great assistance in such a case

6 That when ulceration and "fungation" occurs, the downhill course is much more rapid

Somewhat similar cases have an extremely persistent way of reappearing when removed locally. If this case does this, an effort will be made to report her condition subsequently



FIG 8—Sarcoma of arm present condition after interscapulo thoracic amputation

CARCINOMA OF BREAST DURING PREGNANCY AND LACTATION, ASSOCIATED WITH ABSCESSSES, SUBSEQUENT PREGNANCY ULTIMATE RECOVERY

DOCTOR HUGH AUCHINCLOSS presented a woman thirty-

one years old, who came first under observation February 26, 1924. She had then just stopped nursing her eighth baby because of trouble in her left breast.

There had been a lump in this breast for a year. Two weeks before admission, an abscess developed at this site, with redness, heat, induration and fluctuating swelling. A 2.5 cm incision was made and clear serous fluid released that grew out no organisms. A cyst was suspected, but no carcinoma, though the oozing of blood at the time persisted at subsequent dressings. Two weeks later the incision was enlarged by introducing a finger and a counter-drainage incision made. Two weeks after that a third incision was made, much foul pus evacuated, considerable bleeding encountered and she was admitted to the hospital with a temperature of 105.8° and septic. Culture showed a hæmolytic streptococcus infection, and two days later four incisions were made in the lower hemisphere.

She promptly improved as far as her sepsis was concerned, but the wounds did not heal as they should and from one suspiciously white area a section was made that showed no carcinoma.

CARCINOMA OF BREAST DURING PREGNANCY

About ten days later a second specimen was removed from a place nearer the nipple and carcinoma was definitely found

During the next three weeks twelve X-ray exposures were given. The inflammatory reaction diminished greatly.

May 24, 1924, a widespread radical removal of the breast, axilla and pectoral muscles with subsequent skin grafting was done.

On pathological examination, numerous mitoses were found in the carcinomatous mass—a point of interest—considering the amount of radiation she had had.

Eight lymph-glands from the axilla that was sectioned showed no evidence of carcinoma. She was discharged twenty-six days after operation in good condition.

The summer passed and it was expected in the fall to see this patient return to the Follow-up Clinic with metastases and beginning cachexia. It was a great surprise to find her in splendid health with 100 per cent arm function looking extremely well and no clinical evidence anywhere of metastases.

Seven months afterwards, she returned to the Follow-up Clinic having skipped a period and with the uterus about double its normal size. It was evident she was beginning a pregnancy, and she was advised to have a therapeutic abortion. This she refused to consider, and went through a normal pregnancy, giving birth to a ten-pound baby in August, 1925. She nursed this child five times a day for a short time, did her own housework, and cared for seven children.

She was seen twenty months after operation, looking the picture of health and showed no evidence of metastases.

She is now shown, 1926, almost two years after the operation, apparently in perfect health and with no evidences of metastases. This case is presented because

1 Occasional importance of history in carcinoma of breast, in spite of the disregard of the patient's story, one is frequently justified in assuming in this disease

2 Difficulty of recognition of cancer when infection is present

3 That cancer with infection in a young woman cannot be assumed to have involved the axillary glands, even though they are palpable

4 That not only was lactation and infection in a young woman, factors frequently considered more likely to render cancer of the breast more rapidly fatal—but a second pregnancy and subsequent lactation, experienced with apparently no ill effect whatever

5 That X-ray radiation seemed to have helped the inflammatory reaction. Whether it in any way modified the course of the cancer, no one can tell. Probably not much, if at all.

6 That the more one sees of cancer of the breast, the more is one astonished at the remarkably unexpected happenings that occur in individual cases. Accordingly prognoses are almost futile.

7 In addition, Maud Slye's mouse experiments are of interest. In the *Journal of Cancer Research*, vol. v, January, 1920, No. 1, "Relation of Pregnancy to Tumor Growth," we read "two facts stand out with startling clarity and cannot be gainsaid, viz

"1 Reproducing females grow much less tumor than do non-reproducing females of the same approximate age and general metabolic condition

"2 Reproducing females grow much less tumor while they are reproductive than they do while they are non-reproductive, in other words, *when a*

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mouse is producing embryos, she is not producing tumor in anything like the amount which she grows while non-reproductive"

CONCLUSIONS

"1 Cancer and reproduction, both being growth processes, draw upon the same energy residuum and are made possible by the same food. Hence the food and energy used by one are withheld from the other.

"2 Therefore (a) if the female is constantly pregnant, energy and food are withheld from the tumor and it grows with extreme slowness. (b) If there is a hiatus between pregnancies, or a termination of pregnancy, the energy which was running into reproduction is released and diverted into tumor which grows very rapidly. (c) If tumor growth considerably antedates impregnation, the currents of energy are already being used for tumor growth and are with difficulty diverted for pregnancy, probably never wholly so.

"3 Hence, when a female is well advanced in tumor growth before impregnation there are rarely any offspring brought to birth. When offspring are delivered they are few, small, undernourished, and rarely suckled (which in mice means there is no lactation).

"4 When tumor growth is not interfered with by pregnancy it is (a) extremely rapid in mice which are young, well nourished and vigorous, (b) less rapid in mice older and less vigorous or less nourished, (c) very slow in mice which are old, feeble, undernourished, or afflicted with a destructive complicating disease.

"5 Another point which shows the close relation between the growth of embryos and the growth of tumor is the great frequency with which breast tumors are nearly synchronous with delivery. Hyperstimulation of any tissue seems to originate cancer of those tissues in individuals of cancer tendency, hence the intense stimulation incident upon lactation tends to originate cancer of the breast in individuals of breast cancer tendency.

"6 The prolonged hiatus between pregnancies greatly complicates the study of the relation between pregnancy and tumor growth in the human species. During this prolonged hiatus the tumor may draw off the energy which would have continued to be used in reproduction if the pregnancies were not widely separated, just as is the case in mice kept constantly impregnated. This would account for any apparently conflicting testimony in human experience as compared with these studies.

"The factors are not subject to control in the attempt to study the relation between reproduction and tumor growth in the human species, and the conclusions have to be drawn without knowledge of complicating factors. The real relation between these two can be disclosed only in the experimental laboratory, where the factors are all known and are under control.

"The experimental evidence shows a very striking relation between these two modes of growth, the production of young and the production of tumor, moreover, it shows the same relation between the production of young, and the growth of *all types* of mammary gland tumors."

AXILLARY DISSECTION IN THE RADICAL OPERATION FOR CANCER OF THE BREAST

DOCTOR JOHN E. JENNINGS read a paper with the above title, for which see page 770.

DOCTOR HOWARD LILIENFELD said that he had felt that the skin of the axilla is usually involved late because the lymphatics are deep and close to

the vein, beneath the costocoracoid membrane. Therefore, he had dissected the breast and axillary contents *en bloc*, but had not removed the axillary skin unless it was adherent to the disease, in which case he had removed it. He wished to ask Doctor Jennings if, in his early cases in which he found a doubtful involvement of the axillary nodes on clinical examination, he would plan an operation in this way. It seemed to the speaker that there must be greater tension in drawing this kind of wound together than when the operation was done in the usual way.

DOCTOR ROBERT T. MORRIS said that he was at work with Heidenhain at the time when he made his study of cancer of the breast and found that the minor pectoral muscle and the skin were involved rather later. On a basis of that idea, C. E. Ruth turned the lesser pectoral muscle into the axilla to avoid scar contraction. The speaker had often done the Ruth operation in early cases, but not in late ones. In the latter he preferred to make use of a fat graft taken from the other breast by preference. Doctor Morris felt that skin removal depended much upon the stage of the disease.

DOCTOR BURTON J. LEE said that he would like to ask Doctor Jennings if most of the skin recurrences in his cases had not occurred over the latissimus dorsi tendon rather than over the anterior portion of the axilla. He had found many recurrences in that part of the axilla so that he frequently has extended the dissection posteriorly if he expected a node there. He had felt that by this procedure he had avoided some recurrences.

DOCTOR JOSEPH WIENER said that his reaction to this operation was that of Doctor Lihenthal. In many cases removal of the skin of the axilla has developed, pressure symptoms and often enormous lymphoedema, much more so than with any other operation. This is a very serious matter to the patient. He had one patient who for fifteen years after a breast amputation complained continuously of enormous lymphoedema of the arm.

DOCTOR GEORGE H. SEMKEN said that if the recurrent cases are studied one can learn what should be removed at the primary operation. It was a question, in his mind, whether the pictures shown on the screen represented actual skin permeation by cancer rather than outward invasion by cancer in the lowest group of breast axillary nodes for the low cases, and by cancer in the lymphoid tissue under the axillary hair follicles for the high cases. If the posterior breast skin flap is dissected so thin that it is widely free from the lowest group of axillary nodes, and if the lymphatic tissue under the axillary hair follicles is carefully removed from the flap, these danger points may be avoided. The clusters of metastases that are found about scars usually indicate an insufficient removal of breast-skin, but some are probably implantation metastases. In the axillary dissection it is a wise plan to remove the outer half of the sheath of the axillary vein as a routine procedure. Observation of recurrences in the axilla shows these to be closely attached to the sheath. A simple gauze dissection will not remove all of this axillary lymphatic tissue, but the removal of the sheath of the vein, which is not a difficult matter, will certainly accomplish this. It has the added advantage

of completing the intact fascia envelop, which should enclose the removed axillary fat and lymphatic tissue

DOCTOR EUGENE H POOL said that his reaction to this procedure of Doctor Jennings' was that of the other speakers in the discussion. In reading Doctor Jennings' paper he felt that if there were skin involvement in the axilla the procedure would not do any good and if there were no skin involvement in the axilla the procedure would be unnecessary. Moreover, on anatomical grounds there seemed little reason for it because the lymphatics from the mammary gland pass to the axilla in the deeper tissues and not immediately beneath the skin. Doctor Pool stated that one important feature in Doctor Jennings' paper had not been discussed, namely 66 per cent of three-year cures. Doctor Jennings' careful follow-up system makes these figures especially convincing. The conclusions of one who can report such results demand serious consideration. To attain such results his operations must be very well done and Doctor Pool was inclined to ascribe the success to features other than the skin incision.

DOCTOR JENNINGS said that in his opinion the point of the whole thing was that in cases in which the skin of the axilla is adherent to a growth underneath, it is too late to do anything more than to give palliative treatment. It is the case in which no evidence of cancer beneath the axilla is to be seen which should have wide skin removal. One could not formulate rules as to the involvement of the axillary skin any more than one could for involvement of the lung or liver. As to Doctor Morris' suggestion regarding fat transplant, the speaker tried this in one case and lost the graft and had not tried it since, he expected, however to make the experiment again some time. There need not be great tension on the skin if the skin is sutured with the arm up.

With regard to biopsy, Doctor Jennings had formerly agreed with Doctor Pool that there is a great deal to be said. A few years ago he believed that it was only fair to incise a doubtful tumor rather than to proceed immediately with radical operation and he followed this procedure for a year or two. Three of his cases recurred, however, two in the brain in six months and one with multiple metastases in the long bones. This might have been a coincidence, but he thought it better not to stick knives into doubtful cases. Regarding the inflammatory type that subsided under the X-rays, it might be possible to do a biopsy after vigorous radiation, or it might be better to do a radical operation now that the inflammatory condition has been entirely controlled by radiation. Biopsy, however, is dangerous.

Stated Meeting Held March 24, 1926

The President, DR WALTON MARRIN in the Chair

AVULSION OF SKIN OF ABDOMEN AND PART OF SCROTUM

DOCTOR FENWICK BERKMAN presented a boy, twelve years of age, who September 15, 1924, was admitted to Lincoln Hospital, having been hit by an automobile.

AVULSION OF SKIN OF ABDOMEN AND PART OF SCROTUM

The skin of the abdomen, from the level of the umbilicus and extending from crest to crest of the ilia, had been torn off in an apron-like fashion, the remaining edges were undermined for several inches on each side. The skin of the scrotum on the left side had been torn off as far back as the perineal body. The skin of the penis had separated at the base of the organ and hung over the glans penis, turned inside out like a glove finger. The right side of the scrotum was also turned inside out and the right testis covered with its superficial layers of fascia was exposed. The left testicle had been stripped of all tissue down to the vaginal process and was entirely free except for its attachment by the cord at the external inguinal ring. The crest of the right ilium was fractured as well as the pubic bone.

Two hours after admission the patient was taken to the operating room and given a general anaesthesia. The wound and surrounding skin was thoroughly cleansed with soap and water and the skin was painted with a 5 per cent alcoholic solution of picric acid. The wound was thoroughly débrided and counter-incisions for drainage were made in the dependent parts where the skin edges had been separated. The skin was replaced over the penis and the right testicle was replaced in the scrotum. The problem then arose as to what to do with the left testicle. If it was not taken care of it would undoubtedly become infected and slough, so it was decided to bury it under the skin of the left thigh. The skin was undermined and after the testicle had been thoroughly cleansed it was placed in the subcutaneous tissue in about the region of the saphenous opening without tension on the cord. The subcutaneous tissue was sutured to the deeper structures above it. The entire wound was Dakinized. The patient had an uneventful convalescence, October 15, just one month after the accident, the wound was covered with Thiersch skin grafts and November 30 he was discharged, the wound practically healed. Since then he has been perfectly well.

DOCTOR BEEKMAN presented a case of a solitary cyst in the neck of the left femur. The patient, a girl of six years of age was admitted to the Surgical Division of Lincoln Hospital, September 11, 1925 in the service of Doctor Frederick W. Bancroft. Five days before admission she fell on a cement floor, striking her left hip. Following the accident she was unable to stand. On admission to the hospital, tenderness could be elicited on pressure over the trochanter of the left femur. There was no shortening in the limb and there was a full range of motion at the hip. A roentgenological examination three days later showed a bone cyst of the neck of the femur with a pathological fracture through it. There was no displacement.

The patient was kept in bed without splints. One month after admission, under a general anaesthesia, a U-shaped incision was made with its convexity downwards through the skin and superficial fascia, over the trochanter. This flap was raised and the trochanter was exposed by a vertical incision through the fascia lata and tensor fascia femoris muscle. A large drill hole was made in the trochanter in the direction of the plane of the neck of the femur until the cavity of the cyst was entered. The opening was then enlarged, the cyst contained clear fluid and its walls consisted of a spongy-like bone. The cavity was thoroughly curetted and wiped out with pure carbolic acid and alcohol. A vertical incision was then carried down the side of the thigh for three inches from the lowermost portion of the first incision, splitting the fascia lata. A flap of muscle three-quarters of an inch wide and about one and a half inches long was raised from the under surface of the fascia lata, leaving it attached at its upper end. This was placed in the cavity of the bone and was held there by suturing the rent in the fascia lata with

chromic gut. The skin and superficial fascia were closed with silkworm gut sutures. The wound healed by primary union. Cultures from the cyst showed no growths. X-rays taken at frequent intervals following operation showed a progressive process of new bone formation within the cavity of the cyst. It was not thought that the muscle flap entirely filled the cavity, but it appeared to act as a cork and the new bone was probably laid down in the sterile blood clot beyond the flap as well as in the flap itself.

Bloodgood (*South Med Jour*, vol xiii, pp 888-897, December, 1920) has recently reported fifty cases of solitary bone cyst eighteen of which were in the shaft of the femur. He states that these cysts predominate in the long pipe bones, preferably the femur, and he further says "in the femur its most common situation is in the shaft. I have never observed it in the trochanter, neck or head of the femur." This case, therefore, is interesting because of the location of the cyst. It is well known that most of these cases would be overlooked if pathological fractures did not so often take place. The cause of the cyst is probably of inflammatory origin and Bloodgood says that they will all in time cure themselves. He does not advise operation except as an exploratory measure.

LONG-STANDING ULCER OF THE STOMACH

DOCTOR FORDYCE B. ST. JOHN presented a woman, aged fifty-nine years, who was admitted to the Presbyterian Hospital, January 23, 1923 (a little more than three years ago), with the history, that at the age of

nineteen (1886), she began to have abdominal pain, soon followed by nausea and vomiting, which persisted more or less constantly from that time until the date of her admission to the hospital, a period of thirty-seven years.

At the age of thirty-seven (1903), she had entered a hospital in Germany for relief of this abdominal pain, nausea and vomiting. The pain had increased in severity and the patient had been confined to her bed for two months previous to going to the hospital. She was operated upon at this time by Doctor

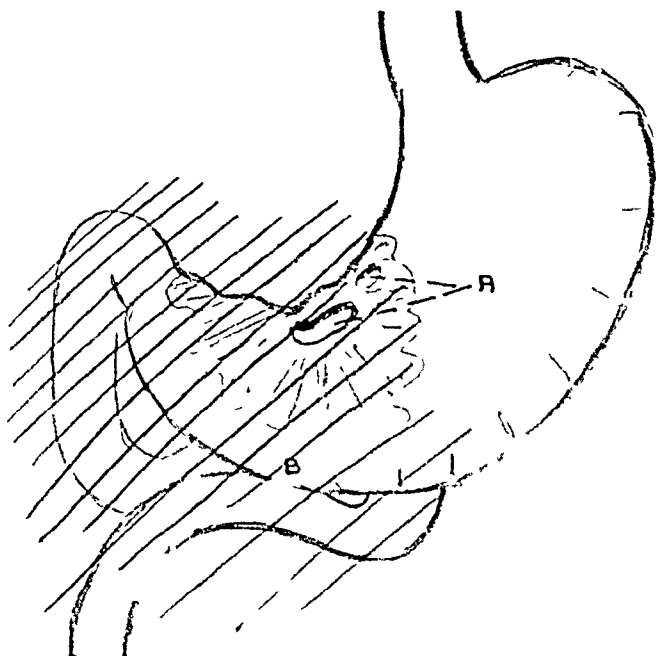


FIG 1.—Diagram showing location of stomach ulcer.

Paul Wolfe, of Hamburg, who, in response to a letter of inquiry, stated that he operated Miss B. for an ulcer of the stomach, which had penetrated deep into the liver. He loosened the stomach, excised the margins of the ulcer, and sutured it. The patient had a smooth recovery. After this first operation she remained in the hospital for three months and then returned home to convalesce. She was followed by her surgeon for a period of two years.

At the age of forty-seven (1913), she returned to the United States,

LONG-STANDING ULCER OF THE STOMACH

where she was again operated upon for relief of severe abdominal pain, associated with nausea and vomiting. The report of this operation is as follows: "The diagnosis in the case of A. B. was gastric ulcer (of the posterior wall of the stomach at the lesser curvature) with adhesions of the stomach to the anterior abdominal wall, liver and pancreas. The operation consisted of an anterior gastro-enterostomy and division of adhesions." Following this procedure, she was relieved for a period of a few months, after which the symptoms recurred.

At the age of fifty (1916), she came to the Presbyterian Hospital with the same symptoms again, especially severe in character. The operation then performed, revealed the following pathology: Extensive adhesions of the omentum to the anterior abdominal wall and to the anterior wall of the stomach. The stomach was also adherent to the under surface of the liver. Four or five centimetres from the pylorus, there was a marked kink of the stomach, and a constriction which seemed to run vertically. Scar tissue on the anterior wall seemed to indicate the presence of an old ulcer. It was at this site that the adhesions were most dense. On the inferior portion of the stomach, the

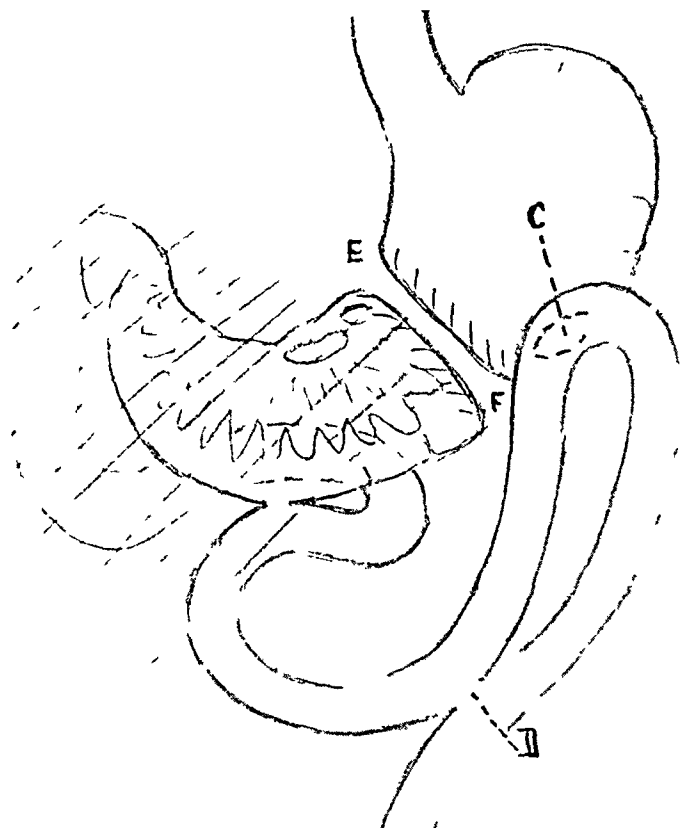


FIG. 2.—Diagram showing elimination of ulcer-bearing portion of stomach from digestion.

gastro-enterostomy was present and seemed patent. It was surrounded by adhesions. The operation consisted of division of adhesions.

The patient received some relief from this procedure, but again it was only temporary, and the pain increased in severity during the two years before her next admission. When the reporter saw the patient at this time, she was having severe abdominal pain relieved by food, which she was taking at two-hour intervals. She was vomiting two or three times a week, and was altogether very miserable. An X-ray of the gastro-intestinal tract revealed the presence of an ulcer—or ulcers—on the lesser curvature, with marked deformity of the pars media.

Because of the severity of the symptoms, exploration was decided upon, it being felt that resection of the ulcer-bearing area of the stomach would be the most satisfactory procedure for the patient if this were technically possible. There was some doubt as to this procedure being possible because of the direct evidence, already obtained, of very extensive adhesions.

The operation was performed on February 2, 1923. A left rectus incision was made lateral to the previous scars, with a transverse extension to the left. With difficulty the proximal portion of the stomach was exposed by carefully

dissecting through adhesions intimately attaching stomach, transverse colon and omentum to the anterior parietal peritoneum. Extensive induration was present on the distal third of the stomach, especially in the region of the lesser curvature, through which the larger of the craters was distinctly palpable, and a lesser crater appreciated, though not as clearly. The entire pylorus was intimately adherent to the anterior parietal peritoneum, and to the under surface of the liver. It was found that the preexisting gastro-enterostomy was retro-colic but attached to the anterior wall of the stomach. The stoma was apparently patent, less than 1 cm. in diameter. It was deemed wise to begin the procedure of exclusion by sectioning the stomach at the junction of the upper third and lower two-thirds, well above the incisura angularis, and if the patient's condition warranted, an attempt at resection of the distal portion of the stomach embedded in adhesions, might be made, with the closing of the upper gastric pouch, and performing an anterior long-loop gastro-jejunostomy.

Two hours having been consumed in the operative procedure, an attempt at resection did not seem justifiable, considering the extent of the pathology, the upper end of the distal gastric pouch was therefore closed, with layer sutures, thus eliminating the ulcer-bearing area from direct digestion, accomplishing anatomical exclusion without subjecting the patient to a prolonged procedure, the feasibility of which was questionable.

The post-operative course was uneventful, except for a rise of temperature to 103 degrees on the eighth day. The temperature immediately dropped to normal on the tenth day, and the patient was discharged on the twentieth day.

At the end of twelve months the woman was working as a practical nurse, eating everything. She had no pain, gas, heartburn, nausea or vomiting. Her bowels were moving regularly without medicine. An abdominal examination was essentially negative, except for the old diastasis of the recti just above the umbilicus.

At the end of twenty-four months, she was again having abdominal pain which had existed for two weeks, associated with very severe constipation, the bowels not moving in three or four days.

She promptly returned to normal in a week, as a result of rest, proper care of the bowels, and a carefully selected diet. Gastro-intestinal X-ray examination revealed the following: "at a point at the level of the entero-enterostomy there seemed to be some narrowing of the efferent loop of the jejunum." This disappeared, and at the end of three years after operation, the patient is active, apparently well, and is eating an unrestricted diet without nausea, pain, or vomiting. She occasionally belches gas.

DOCTOR RICHARD LEWISOHN remarked that this case demonstrated very well the unfortunate results of conservative surgery in these ulcers. One so often hears the advice to do the simpler operation first and the radical later when the necessity should arise. Of course, in this case no one can blame the surgeon for doing a conservative operation, for the primary operation was performed thirty years ago. The complete operation (subtotal gastrectomy) should be done as the first procedure. This patient has had three operations so far, extending over a period of thirty years, and it is doubtful whether she is cured.

LATE RESULT OF BILIARY FISTULA

LATE RESULT OF BILIARY FISTULA WITH IMPLANTATION OF FISTULOUS TRACT INTO STOMACH

DOCTOR FORDYCE B. ST. JOHN presented a man, thirty-one years of age, who was admitted to the Presbyterian Hospital, April 5, 1924, with the history that two months previously he began to feel badly, with loss of strength and appetite. He became jaundiced, and had clay-colored stools. He went to an osteopath, who gave him very strenuous manipulation, in the course of which he "pummelled him in the region of the liver." The following day, he had severe, sharp pain in the right upper quadrant, going to the

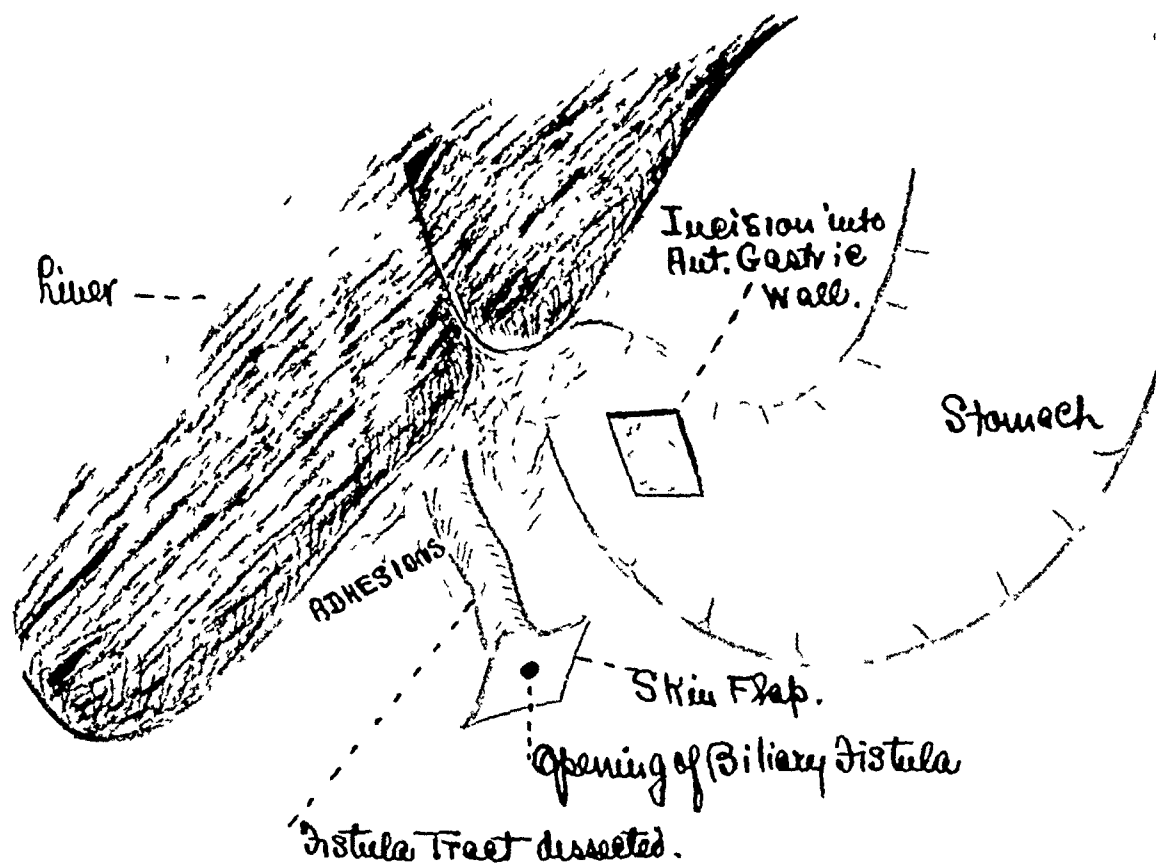


FIG. 3 — Implantation of biliary fistulous tract into stomach, first step

back. He vomited two or three times. He remained in bed about a week, and then gradually felt somewhat better.

One month before admission he began to have recurrence of the pain in the right upper quadrant, unassociated with nausea or vomiting, but associated with light-colored stools.

Two days before admission he had a severe attack of pain in the right upper quadrant, radiating to the back.

On admission, he was slightly jaundiced, uncomfortable with pain, and there was considerable muscle spasm in the epigastrium and right upper quadrant. His temperature was 99 degrees, pulse relatively normal, respiration 24. White blood cells, 13,500, polymorphonuclears, 76. There was a trace of bile in the urine. A diagnosis of "acute cholecystitis" was made and an operation performed.

There was marked distention of the gall-bladder, which was gray in color with fibrin on its surface and apparent oedema of the wall. No bile

was present in the peritoneal cavity. The gall-bladder was so large and tense that it was aspirated several times before removal, the latter being accomplished by dissection from the fundus toward the cystic duct. The cystic duct was inspected, but did not appear enlarged and no calculi could be palpated along its course. During the removal of the gall-bladder some difficulty was experienced with oozing from a small vessel in the vicinity of the cystic artery, but near the common duct. This was clamped and ligated with the common duct in view, and apparently not compromised. A cigarette drain was placed down to Morrison's pouch and the wound closed.

Pathological examination of the gall-bladder revealed a wall 6 or 7 mm

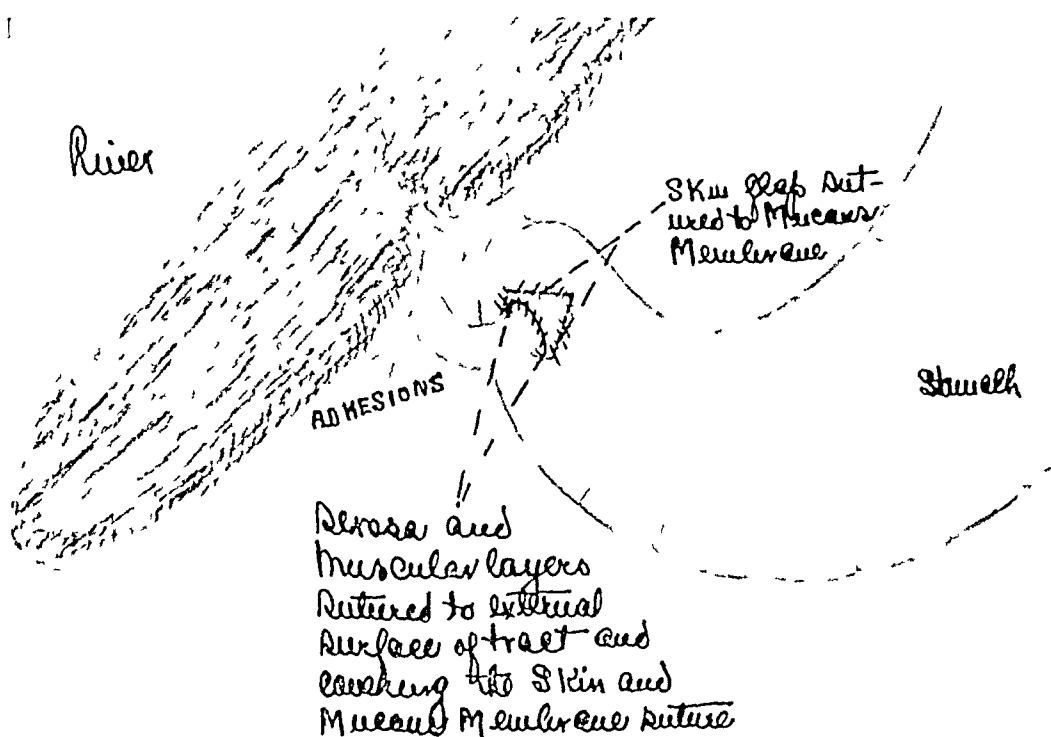


FIG. 1.—The implantation completed

thick, with no calculi present. The mucosa was destroyed, its place being taken by fibrin. There was extensive blood extravasation in the submucosa, with some cedema and leucocytic infiltration. The subserosa was enormously thickened by cedema and fibroblast infiltration. It was evidently an acute exacerbation on top of an old chronic cholecystitis.

Post-operative course. The patient developed post-operative pneumonia which he handled well. On the second day the dressing of the wound was inspected, with evidence only of dry serum. On the third day, up to which time he had been definitely jaundiced, the dressing was soaked with bile. From this time on, the biliary fistula persisted, and the stool was repeatedly negative for bile, until the patient was given his own bile by mouth, which he took for a period of five weeks.

On the eighty-sixth day after operation, a second operation was performed, at which the following pathology was noted. The great omentum and transverse colon, the liver, duodenum and stomach were adherent. A probe introduced into the mouth of the sinus passed down immediately beneath the inferior surface of the right lobe of the liver, where the sinus

MULTIPLE FRACTURES IN CHILD

tract was lost in dense adhesions. The pre-pyloric region of the stomach was visible and the duodenum was not. A decision was made to dissect the distal portion of the sinus, including the surrounding skin for about 1 cm in all directions, and implant this into the pre-pyloric segment. This was done after making a longitudinal incision in the anterior wall of the stomach, about 3 cm in length, and suturing the mucous membrane to the skin margin of the sinus, throughout its entire extent. Musculature was later repaired to the margin of the sinus tract, and a bit of the great omentum lightly sutured over the anastomosis. The wound was closed without drainage.

The post-operative course was uneventful. There was no leakage of bile at any time. The wound healed by primary union, and the patient was discharged twenty-six days after the last procedure, bile having been present consistently in the stool, after operation, and there having been no jaundice.

One year after the second operation, the patient had gained sixty pounds. He was symptom-free, was having no indigestion, his appetite was excellent, and his bowels were moving daily without medicine. There had never been a suggestion of jaundice.

Now, twenty-one months after the second operation, the patient is symptom-free, his appetite is excellent, and he is eating everything. He has not lost a day's work in sixteen months.

DOCTOR HERMANN FISCHER said that almost every surgeon who does a large amount of gall-bladder work has at some time encountered annoying hemorrhages from large cystic arteries or irregular branches of the cystic and hepatic arteries. These hemorrhages are, under certain conditions, very troublesome and very often the cause of injuries to the hepatic or common duct, these structures being caught by clamps or ligatures in the endeavor to stop the hemorrhage in an operation field obscured by bleeding. There is a simple method to control such bleeding immediately and with certainty. This consists in compressing the structures which run in the hepato-duodenal ligament by inserting the index finger of the left hand into the foramen of Winslow, hooking it up and thereby putting it on the stretch. By doing this the hemorrhage can be stopped immediately, the operative field wiped clean from blood. By relaxing the pull somewhat, one is able to see the bleeding artery and can clamp it without injuring the neighboring structures. He had not seen this simple measure described in the text-books and he thought it might be worth while to mention it. The method helped him out of a predicament in a case in which he had just tied a cystic artery of about the size of a goose-quill. The patient took a very bad narcosis, for some reason or other the ligature slipped just at the time when the patient stopped breathing. It was indeed, a very disagreeable situation, which, however, was successfully overcome by this little trick.

MULTIPLE FRACTURES IN CHILD PYEMIC ORIGIN (?)

DOCTOR JAMES I. RUSSELL presented a baby, aged six months, who was admitted to Roosevelt Hospital, October 25, 1925, with the history that it had been quite well until three weeks before admission, when he cried continually without apparent cause. It was then noticed that there was slight swelling and redness about the middle of the left lower leg. Shortly afterwards there was a similar swelling and redness near the lower end of the

right forearm. The right lower leg and the left forearm followed in turn with slight redness and abnormal mobility. The parents were told that the child had fractures and splints were applied. The area of redness and swelling in the right forearm increased and an incision was made on the volar surface near the wrist with evacuation of pus. At time of admission to the hospital there was a discharging sinus in the right forearm at the point of this incision. There was no definite history of trauma. The child's general condition had been good up until the present illness. He was breast-fed for two weeks, supplementary feeding about four weeks longer, and then a bottle-fed baby.

The weight was fourteen pounds on admission. At time of admission the child was an ill-nourished, pale baby with a temperature of 102° , white blood cells 29,000, red blood cells 3,840,000, haemoglobin 60 per cent. Blood smear was normal, except for the pale staining. No abnormal forms of the blood cells. Wassermann was negative. Von Piquet negative. Blood culture was sterile.

X-rays demonstrated oblique fractures in both tibia with good apposition and good repair. Plates of the right forearm showed fractures of both the radius and the ulna with some loss of substance. Plates of the left forearm showed fracture of the upper third of the radius. The lungs and pleura were negative, heart normal. The rib ends, as well as some of the epiphyseal lines in the long bones showed suggestive Ricketic changes. X-ray of the skull showed no changes.

A red, tender area of the left forearm developed and at the same time swelling of the right supraclavicular region. These increased in size and were incised two weeks after admission. Culture of these showed non-haemolytic streptococcus.

The temperature ranged between 102 and 101° plus for one week after admission, then shaded off with slight elevations until opening of the abscess, two weeks after admission, and from then on there were slight elevations from time to time. The wounds healed promptly without drainage.

Alpine light exposures were given every day during his last two months in the hospital.

Upon discharge, four months after admission, all fractures were firmly united, weight was nineteen pounds, four ounces.

Five days ago the child slapped his father, causing a re-fracture of the right forearm. Since his discharge from the hospital he has continued to gain weight. The position of both bones of the right forearm is good, which is maintained with anterior splints.

ACTINOMYCOSIS OF ABDOMEN

DOCTOR JAMES I. RUSSELL presented a woman, twenty-six years of age, who was admitted to hospital, March 7, 1924, with a history that one year ago she had an attack of lower abdominal pain which illness continued for several weeks until finally an abscess ruptured, discharging through the rectum. After this she had been well until two weeks ago, when pain appeared in the lower abdomen. A few days afterwards a swelling appeared in the left inguinal region which had gradually increased.

Examination showed a definite localized swelling in the left lower abdomen just above Poupart's ligament. The skin was red, tender and fluctuant. This was incised under gas, oxygen. There developed a sinus which continued to discharge when she returned to the hospital, three months later, for further examination.

ACTINOMYCOSIS OF ABDOMEN

No further operation was done at this time. Two months later the patient reentered the hospital, the process having extended with blotchy indurated areas over the buttock with points of fluctuation, suggestive of actinomycosis.

A second operation was then done and the greater portion of the tissue over the left buttock was excised, incision extending down through the abdominal wall over the crest of the ilium connecting up the original sinus. The ray fungus was demonstrated in the tissue and in the discharge at this time.

She was treated with solutions of iodine locally and with increasing doses of iodide of potassium.

Four weeks after the operation X-ray exposures were given at stated intervals. These were continued from time to time during the process of the healing. The wounds improved greatly, healed, and have remained closed for the past fourteen months. Her health has greatly improved and she has gained about thirty-five pounds.

DOCTOR WALTER M. BRICKNER said that this case might be classed with the group of five cured cases which he had reported under the title of "pelvic actinomycosis"—although he believes that their origin is abdominal, that is intestinal. It has been shown that actinomycetes may pass through the intestinal wall, leaving no trace, and it has also been found, as was well demonstrated in one of Doctor Brickner's cases, that an intestinal actinomycosis may completely subside while the disease is spreading to other tissues.

In his cases potassium iodide did not exercise any demonstrable benefit, even though given in huge and persistent dosage, nor did he observe that iodine locally, copper sulphate, etc., were of specific benefit. In four of his five cases the cure was due to bold and persistent surgical attack. In the more superficial cervico-facial and buccal actinomycosis potassium iodide, copper sulphate, X-rays, radium, salvarsan and vaccines have all given some very satisfactory results, usually in association with surgical evacuation. In deeper-seated, visceral actinomycosis, however, these measures are of doubtful helpfulness. Many cases are reported as having taken potassium iodide "pound after pound and month after month" without benefit. It must be remembered, too, that occasionally actinomycosis undergoes spontaneous recovery and, rarely, even pulmonary actinomycosis is cured by expectoration.

The "sulphur granule" is a diagnostic fetish! Its appearance in the pus is so vagarious that if one insists upon finding these bodies in order to establish the diagnosis, he may sometimes have to wait for an autopsy in order to do so. These granules may disappear from the pus after a few weeks and not again be found therein, or they may be found only in the solid tissues, or they may not appear in the pus for many months. From the clinical side, too, one can make no distinction between those lesions showing only mycelial streptothrix and those showing typical ray fungus and sulphur granules, to which Wright would limit the disease *actinomycosis hominis*. One should be prepared to make a clinical diagnosis of actinomycosis when the history, the appearance and, sometimes, the odor, are characteristic.

LATE RESULT OF OSTEOCHONDROMA OF RIB

DOCTOR JOHN C A GERSHBERG reported the case of a man, well eight years after operation for a large osteochondroma of the ribs, developing after trauma. There were bony exostoses of humerus and tibia of over forty years' standing. He presented himself April 26, 1918 with the following history.

In July, 1917, he accidentally struck the left lower part of his thorax. Three months later, the injured area became swollen and for the past nine months increase in size had been marked. Some abdominal discomfort after meals for the past eight weeks. Examination disclosed a large flat tumor, the size of a man's hand, involving the left lower thoracic wall from just in front of the nipple line to behind the posterior axillary line. The lower margin corresponded with the free margin of the ribs. The surface was flat, smooth and raised fully an inch above that of the adjacent chest wall. The overlying skin was tensely drawn. There was a sense of elasticity over the centre, the margins were hard, smooth, and fixed to the ribs. It was flat to percussion. There was no tenderness. X-ray showed a tumor mainly intra-abdominal, nine-tenths of which lay internal to the lower bony thorax. In addition to this tumor of the thoracic wall, there were exostoses of the right humerus and right fibula, noted since the ages of twenty-two and eighteen, respectively. The rest of history and physical examination revealed nothing abnormal.

Operation April 30, 1918, consisted of excision of an osteochondroma on the left side, involving the ninth, tenth, eleventh and twelfth ribs, and lower chondrocostal margin. From the moment of opening the pleural until closure of the chest, intratracheal narcosis was employed, using small quantities of ether in addition to nitrous oxide and oxygen. Respirations were quiet, the color was good and the pulse did not rise above 90. The skin incision, including subcutaneous fat, began in front in the median line about three fingers below the ensiform, then ran backward along the lower margin of the tumor almost to the vertebral column. This large flap was then dissected upwards to well above the upper margin of the tumor. The abdominal wall was now divided by a transverse incision along the left costal margin and, by introducing the hand one could feel the coral-like surface of the intra-abdominal portion of the tumor which was the size of a grape fruit. There were no adhesions. Beginning at the posterior angle of the abdominal wound, one-half inch behind the tumor, one inch of the twelfth, eleventh, tenth and ninth ribs was resected. The intercostal vessels were ligated before being divided. This permitted the hand to be inserted into the thorax to determine the upper margin of the tumor. The soft parts of the eighth interspace were divided as far forward as the anterior margin of the tumor, where the costal cartilages were divided, thus completing the division of its parietal attachment. It was now free except for diaphragmatic attachment. This was severed close to the tumor, completing the removal. The left lung, and pleural cavity and pericardium appeared normal. There were no secondary chondromatous deposits.

The abdominal cavity was closed by uniting margins of diaphragm to abdominal wall, under considerable tension. This was partly relieved by incising upper surface of diaphragm parallel to its free margin and transversely to muscular fibres, but not dividing subdiaphragmatic fascia. The left pleural cavity was closed by turning down the skin and subcutaneous flap and suturing the fat to the upper surface of the diaphragm two and one-half inches or three inches above the flap's cut edge. This left subcutaneous fat in contact with the lung for a space of three inches long by one and one-half

MASSIVE GASTRIC HEMORRHAGE

inches wide. Skin edges were approximated with a running suture of silk and a dry compressive dressing then applied.

The specimen measured sixteen and one-half by twelve and one-half by eleven and one-half cm. It weighed 1200 grams. The abdominal aspect was stony hard and covered with numerous coral-like excrescences. The external surface was smooth and fluctuating. Incision into this revealed cartilaginous tissue with numerous spaces filled with clear, slightly yellowish mucoid fluid. Through the midst of the tumor passed several ribs and their cartilages. Microscopical examination proved the tumor to be an osteochondroma. Convalescence was uneventful. There was some effusion in the left pleural cavity for a few days after operation. A slight marginal necrosis of the skin developed along the lower border of the large skin flap, one-half inch wide and four inches long. The patient was discharged on the twenty-sixth day after operation. X-ray showed a poorer aeration of the left lung than of the right. Since then the patient has been enjoying good health except that he is somewhat short of breath upon exertion. It is now one month less than eight years after operation. There are no signs of local or general recurrence.

MASSIVE GASTRIC HEMORRHAGE TWENTY-SEVEN MONTHS AFTER FINNEY PYLOROPLASTY

DOCTOR GERSTER presented a man, forty-seven years old, who was first admitted to the Lenox Hill Hospital, service of Doctor DeWitt Stetten, July 4, 1922, with an acute perforated gastric ulcer of six hours' standing. The perforation involved the anterior stomach wall one inch proximal to the pyloric ring and was closed with a single mattress suture of heavy silk. Uneventful recovery followed, and he was discharged on the eighth of August, 1922. August 11, 1923, he returned with symptoms of marked gastric retention, and much loss of weight. X-ray examination revealed large twenty-four-hour retention of bismuth. At operation, August 16, the scar of the old perforation was barely visible, it showed no induration and the silk suture could be seen and felt beneath the peritoneum. The pylorus was extremely small but not scarred. In the course of a typical Finney pyloroplasty, when the stomach and duodenum were opened, the gastric wall was everted and the former site of perforation could not be seen or felt in the mucous membrane, which appeared entirely normal. He made an uneventful convalescence in spite of dietetic indiscretions, for example, eating one-half pound of rock candy on the fourth day after operation. On the eighteenth day after operation, X-ray showed the stomach completely emptied in three and one-half hours. He was discharged well on the twenty-first day, September 5, 1923. He gained nearly thirty pounds within a month.

January 9, 1926, he presented himself, saying that he had been entirely well until thirty-six hours before, when he suddenly felt pains in the epigastrium identical with those he had experienced prior to the perforation of his ulcer. These pains had lasted up to within a few hours of his application for advice, and then suddenly ceased. Physical examination revealed nothing abnormal. Twelve hours later, he came into the hospital because of a massive gastric hemorrhage. Under conservative treatment, including Sippy diet, he recovered and was able to leave the hospital January 30. X-ray at this time revealed rapid emptying of the stomach which began immediately upon ingestion of barium. There was some slight deformity of the duodenal cap attributable to pyloroplasty. No local tenderness.

It is to be noted that the patient prior to his hemorrhage had been working very hard, at least sixteen hours a day, for several months. Whether the

strain of this was a contributing factor in the occurrence of his gastric hemorrhage, must at least be considered

DOCTOR RICHARD LLWISOHN said that the massive hemorrhage was undoubtedly due to reactivation of the old ulcer or to a new ulcer which had formed. This patient may have a new ulcer in the duodenum or in the antrum. The Finney operation can only be used in a certain number of cases where the ulcer is situated on the *anterior* wall of the duodenum and this location is only encountered in one out of three patients. Even in cases where the ulcer is easily excisable and the Finney can be performed, it is doubtful whether the late results are very good. In some of these cases the results were excellent, but in many the operation was a failure. The ideal operation for cases of duodenal ulcer is sub-total gastrectomy.

DOCTOR GLRSTER rejoined that all these cases could not be put into one category. He felt that he would rather divide his surgical procedures into two or three stages and have a living patient than to always perform a primary radical operation and risk losing the case. He had considered resection in his case but felt that this was only advisable on theoretical grounds and that it was better to give the man a chance for spontaneous recovery. If he has a recurrence he can still be operated upon and he is being kept under observation.

BRONCHIECTASIS WITH THORACIC FISTULA

DOCTOR HOWARD LILIENTHAL presented a man, who came to him when he was twenty-seven years old in January, 1924. He was suffering from a characteristic putrid lung abscess of the upper lobe of the left lung, the symptoms of which appeared first about ten days after his tonsils had been removed under ether anaesthesia. Artificial pneumothorax had been induced at another hospital but without any improvement.

When seen by the reporter he was an emaciated septic individual with a fever of 102, expectorating between six and eight ounces a day. There was clubbing of the fingers. The X-ray picture revealed the characteristic appearance of a pulmonary cavity with a fluid line. The cavity was near the anterior chest wall and its centre was about at the level of the third rib in front. This anterior location of these abscesses is different from the location of tuberculous cavities of the upper lobe which begin almost invariably behind.

February 14, of the same year, he operated upon this man at Mt Sinai Hospital, making an incision over the fourth rib, beginning at the right of the nipple and running toward the axilla parallel with the rib for about four inches. Another incision was made at right angles to this and near its middle downward and backward for about three inches. The fibres of the major pectoral were cut across and also some of the pectoralis minor and serratus. About two and one-half inches of the third rib were resected with the periosteum. Then a large aspirating needle was pushed through the indurated tissue into the abscess, withdrawing foul gas and a little pus. The opening was enlarged with dissecting scissors and several ounces of stinking putty-like material were expelled through the wound. The exploring finger revealed that there was still pocketing downward and therefore one and one-half inches of the fifth rib were taken away and the opening in the chest wall was made large as it could be through this exposure. The cavity was packed with rubber dam. Since this time he had followed this patient continuously.

A STUDY IN DISINFECTION OF THE HANDS

and had maintained a fistula which connects with a bronchus. The X-ray pictures now do not show an actual cavity, but here and there are small rarefied areas which indicate a bronchiectatic condition adjoining the general location of the fistula.

The changes of dressings in this case had been rather annoying because the patient who rapidly regained his health and strength wished to go to work and the daily removal of the discharges was troublesome to him. At last a plugged drainage tube was dressed, the plug of which could be removed once a day for purposes of emptying. There is now not a large quantity of discharge and instead of a tube he wears a solid plug made out of a good-sized rubber ligature. This is prevented from slipping into the sinus by a safety pin.

While this is a case in which a cure may be possible through an extensive operation, this man feels well, is strong and able to work and doesn't wish to be operated upon at present. The sinus gives him little trouble. It is dressed with a bit of gauze which is held in place by a piece of elastic adhesive plaster, an ideal method of retaining a dressing upon the chest without the necessity of bandaging and without compressing the healthy side. This same piece of elastic plaster can be used for two or three weeks when it may be replaced by another piece. In order to prevent the plaster from sticking to the gauze, it is necessary to cover this part of the adhesive surface with a bit of the cinnoline backing.

The object of using the same piece of plaster for such a length of time is not because of economy, but because it avoids the necessity of irritating the skin by frequent changes.

This plaster the reporter had found extremely useful in many other ways. For example, there is nothing else which is so conducive to the comfort of a patient with any condition in which pain depends upon respiratory motion of the chest. It is valuable in pleurisy. He had found it almost indispensable in supporting the chest and in retaining the dressings following extra-pleural thoracoplasty.

It is essential that the ends of the plaster be held by ordinary adhesive strips of the same width so as to prevent the ends from curling up.

A STUDY IN DISINFECTION OF THE HANDS

DOCTOR HOWARD LILIENTHAL and JEROME ZIEGLER presented a paper with the above title, for which see page 831.

DOCTOR ALFRED S. TAYLOR said that he had done some experimental work himself on the sterilization of the hands, in which he tested out all known methods, including that with lime and soda. The man who originated that method was Mr. Rauschen, who was a pharmacist and who said the difficulties with it were the result of not using it properly. It is necessary to have crystals of washing soda, and one good-sized crystal with one-half the amount of lime mixed with just enough water to moisten them would be absolutely efficient. If properly used one can get sterile cultures in 95 per cent, and the speaker has done that repeatedly. The prophylactic method of keeping one's hands away from infection is seldom mentioned, but the lack of this is too often seen.

DOCTOR WALTER M. BRICKNER said that he had recently read the published report of a study of the comparative value of various antiseptics on the skin, in which it was found that the lime and soda method was more

germicidal than tincture of iodine, both on the skin of the field of operation as well as on the surgeon's hands Doctor Bückner said that he believed the lime and soda method had been abandoned by many surgeons because the odor on the hands is so persistent To a less extent he found the same objection to iodine on the hands Used only once a day, however, and merely on the finger tips, it is scarcely objectionable from this standpoint and no doubt kills off many organisms about the nails

DOCTOR JOHN C A GERSTER thought that with the use of rubber gloves, if intact, there was not as much chance of operative infection as there was through inadvertent reinfection after the most thorough scrubbing up A patch of dry skin covered with soap may be left after the scrubbing up on ulnar side of elbow, or a long-sleeved gown in being pulled on will touch an unsterilized surface In short, any number of inadvertent contaminations can be seen daily in any hospital, and it is seldom that the operator's hands *per se* are responsible for infection

DOCTOR LILIENTHAL said that he did not deprecate the value of lime and soda, properly applied this method is effective, but it has to be properly applied On the other hand, the iodine method does not have to be learned and is therefore the simplest method On the speaker's hands it has not been irritating and lime and soda is irritating, besides having, as Doctor Brickner stated, a disagreeable odor There is no odor when iodine is removed from the fingers after the first operation Doctor Gerster's discussion did not apply because the subject of the paper was not on operating-room technic, but on disinfecting the hands The method has been used by the men working with Doctor Lilienthal for a long time and they have proven to themselves that it is good Doctor Gerster, however, mentioned one thing which the speaker had referred to when he said one can see dry places on the hands when scrubbing up, one can see black places if one experiments with lamp-black and oil which cannot be gotten off with ordinary soap or even with green soap

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Mayo Clinic (Table I) Twenty-one of these patients had fresh fractures, so are not considered in this study, thirty-one came complaining of painful hips, but union seemed complete or nearly so and no treatment was recommended, and ten patients had pathologic fractures due to syphilis, osteomye-

TABLE I

*Cases of Fractures of Neck of Femur at Mayo Clinic
Between January 1, 1919 and December 31, 1925*

Type of fracture	Cases
United, with arthritis, pain, and so forth	31
Non-union, operation not advised (old age)	66
Non-union, pathologic	10
Recent	21
Non-union, operation advised but not performed	12
Non-union, operation performed	32
Mal-union	3
total	175

litis, or bone tumors, thus the number of patients that could legitimately be considered for surgical treatment was reduced to 113

However, most of the 113 were not considered suitable for surgical treatment, as only thirty-five (31 per cent) were operated on, thirty-two (28.3 per cent) for non-union of the neck of the femur, and three (2.7 per cent) for mal-union. Of the seventy-eight patients (69 per cent) who did not receive surgical treatment, there were twelve for whom operation was advised, but for various reasons was not carried out and sixty-six for whom operation was not advised because of old age, debility, slight disability, and so forth. This type of operation entails a long stay in hospital, and when the facts are fairly presented some patients are unwilling or unable to make the sacrifice

TABLE II

Results of Operation for Non-union of Neck of Femur

Operation	Not known	Not cured	Cured
Bone graft	2	5	16
Beef bone	0	0	3
Brackett	0	0	2
Whitman	0	0	4
Whole group	2	5	25
			83 per cent cured

Therefore but thirty-two patients received treatment for non-union of the neck of the femur. An analysis of the various types of operations performed and the results obtained is of interest. Taking the group as a whole, regardless of the means employed, a satisfactory result was attained in twenty-

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five instances That means that the patients were enabled to discard all supports such as crutches and canes, and again take part in their ordinary social and business activities Some, it is true, had a slight limp and a certain degree of stiffness, but all concerned were satisfied

A study of the results shows that there were no real failures except from the bone grafts (Table II) It must be remembered, however, that the aim in

TABLE III

Patients Operated on for Non-union of the Hip From January 1, 1919 to December 31, 1925

Age, years	Sex	Duration of non-union, years	Operation	Cure	Failure	Not traced
53	F	0 5	Graft from fibula	0	+	0
45	F	0 75	Beef bone screw	+	0	0
41	M	0 5	Beef bone peg	+	0	0
			Graft from fibula			
44	M	0 5	Beef bone screw	+	0	0
30	F	0 75	Graft from fibula	+	0	0
35	F	0 5	Graft from fibula	+	0	0
53	M	0 5	Graft from fibula	+	0	0
37	M	1 0	Graft from fibula	+	0	0
49	F	1 0	Brackett	+	0	0
18	F	3 0	Brackett	+	0	0
28	F	3 5	Graft from fibula	0	0	+
58	M	1 5	Graft from fibula	+	0	0
52	F	0 5	Graft from fibula	0	+	0(death)
53	M	1 0	Graft from fibula	+	0	0
21	M	1 5	Graft from fibula	+	0	0
58	F	1 0	Whitman	+	0	0
55	M	2 0	Graft from fibula	0	+	0
35	M	1 5	Graft from fibula	+	0	0
46	F	1 5	Plastic Beef bone screw	+	0	0
40	M	2 0	Graft from fibula	+	0	0
47	M	0 5	Graft from fibula	0	+	0
40	M	0 5	Graft from fibula	0	+	0
50	F	0 5	Graft from fibula	+	0	0
52	M	3 0	Graft from fibula	+	0	0
39	F	2 5	Graft from fibula	+	0	0
32	M	1 0	Graft from fibula	+	0	0
54	F	1 5	Whitman	+	0	0
52	M	1 0	Graft from fibula	+	0	0
49	F	2 0	Graft from fibula	+	0	0
46	F	4 0	Whitman	+	0	0
68	F	3 0	Whitman	+	0	0
44	F	2 0	Graft from fibula	0	0	+

this type of operation is much higher, a more or less anatomic restoration being carried out, the technic is correspondingly difficult

The sexes were about evenly divided, there being seventeen females and fifteen males The ages ranged from eighteen to sixty-eight years, one girl was eighteen, two patients were between twenty and twenty-nine, six between thirty and thirty-nine, eleven between forty and forty-nine, eleven between fifty and fifty-five, and one woman was sixty-eight The duration of the non-union varied from four months to four years Fifteen patients had had non-union more than eighteen months, eight more than two years, five more than

three years. Of the last group the Whitman operation was used in two, in one the Brackett operation, and in two the bone-graft operation. In one of the latter the result is not known, but in the other case (a man aged fifty-two) the result was practically perfect. It was difficult to assign a definite cause for the non-union in each case, but, as is usual in this condition, the prime cause was lack of treatment, or, at best, treatment only for sprains, and so forth, at the time of the accident because no diagnosis was made. The next most important cause was the carrying out of poorly planned or poorly controlled treatment. There are now sufficient reports in the literature to establish the fact that the large majority of recent fractures of the hip will unite if logically treated by the abduction method.

There was one death, in the case of a healthy woman, aged fifty-two, following a well-executed bone-graft, as was shown at necropsy. This operation has naturally been classed as one of the failures, but, had it not been for the distressing accident of a cerebral embolus, union might reasonably have been expected. The embolus, a small one, evidently arose in the common iliac vein, travelled to the heart, and found its way through the patent foramen ovale to the brain. The patient became unconscious soon after awakening from the anæsthetic, and died two days later.

Calcium and phosphorus studies were made on some patients, but the findings were not conclusive.

SUMMARY AND CONCLUSIONS

The autogenous bone-graft, wherein the aim is to restore as nearly as possible the normal condition, is the operation of choice, and the fact that success was attained in 76 per cent of twenty-one cases indicates that it compares favorably with the bone-graft for non-union in other bones. In three cases the same happy result was accomplished by using the beef-bone screws, but these cases were more favorable in every way. The remodelling operations of Brackett and Whitman were carried out in six other cases with good results in all. In the latter group, however, there was more residual stiffness than in the former group, and function, although satisfactory, was by no means as good. The duration of the non-union is no criterion in selecting the type of operation. Some of the best results followed the anatomic type of operation, using the bone-graft, when non-union had existed for two and one-half and three years.

The autogenous bone-graft should be used in cases of non-union of the hip when the patient is in good health, when the disability is considerable, and when enough of the neck of the femur is left. One cannot state what the maximal age should be for this operation, but it is my opinion that if the patient is more than fifty-five, one of the other types of operation, such as that advocated by Brackett, Whitman or Albee, should be employed. Each

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patient is an individual study not only as concerns the local condition, that is, the condition of the neck of the femur and the femoral head, but also the general health, age, social status, degree of disability, suffering, and so forth

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TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY

Stated Meeting Held January 27, 1926

The President, DR WALTON MARTIN, in the Chair

SEPTIC ARTHRITIS OF KNEE

DR CHARLES E FARR presented a girl, six years old, who entered St Mary's Free Hospital for Children, May 12, 1925, and is still resident there. She had been run down and knocked over by an automobile immediately before admission, sustaining a compound, comminuted fracture of the right femur about the middle third, with a complete loss of skin over the mid-thigh to the lower third of the leg. A bridge of skin two inches wide passed across this gap, but was completely lifted from the underlying structures and was evidently sure to slough. The shock was so extreme that amputation was inadvisable, and on the other hand, the muscles, nerves, and vessels were normal and intact. After careful deliberation it was decided to try to save the extremity. A thorough debridement was carried out, a pin passed through the os calcis for traction, and Dakin's irrigation instituted. In addition various supportive measures for shock were carried out. The child rallied feebly, and a severe infection set in. The skin sloughed widely and general sepsis ensued of the streptococcus non-hæmolytic type. This was combated in the usual way with supportive measures and transfusions.

About the thirteenth day the opposite knee became involved in an acute septic arthritis. After observation for five days this knee was widely opened on either side by Doctor Freeman, and a large amount of pus containing the non-hæmolytic streptococcus evacuated. No drains were placed, only a small dressing was applied, and vigorous attempts were made to induce active motion. This was carried out by tickling the sole of the foot, causing the child to flex the knee to the point of pain. Then by gentle traction the leg was again extended. There was slow but steady progress in the use of the joint, and it healed in a comparatively few weeks. The general sepsis had subsided. Union eventually occurred in the fractured femur with considerable loss of bone and moderate bowing. A very large surface remained for skin grafting. This was carried out in stages and eventually was completely successful.

Flexion and extension of the infected joint are now normal. Weight-bearing causes no symptoms. There is a barely perceptible soft creaking, but no other remaining evidence of synovitis. This is the seventh consecutive case of septic arthritis of the knee in children which the reporter had treated in this manner. Of these six have given perfect results, and one only, in whom active motion could not be induced, resulted in a permanently stiff joint.

BOWEL INFLATION FOR INTUSSUSCEPTION

DOCTOR FARR presented a male infant, seven months of age, who entered St Mary's Free Hospital for Children, October 15, 1925. He was a breast-fed child in the most robust condition and with no past illness and no relevant family history.

CONTUSION OF THE ABDOMEN

Present illness began forty-eight hours before admission with a history typical of intussusception. He had colic, vomited repeatedly, had one normal stool which was followed by a small stool of mucus and blood. The child was in marked shock, and vomited at intervals. There was a little blood in the rectal mucus and a mass could be felt in the left lower quadrant.

The child was anesthetized with ether, the nozzle of a Davison syringe inserted in the rectum, and the colon inflated with air. This procedure was carried out on the operating table during the course of preparation for laparotomy. The mass in the left lower quadrant rose to the left upper, passed across the epigastrium to the right upper, and then to the right lower quadrant. Here it seemed to disappear and a fairly careful examination under the anæsthetic failed to reveal any further evidence of a mass. The abdomen was then opened with a split right rectus incision, and the only findings were very marked congestion and œdema of the lower ileum, the cæcum, and the ascending colon. The appendix was very hemorrhagic but was not removed. The ileum was considerably distended with gas but no further lesions were found and the abdomen was closed. The child was in considerable shock for the first twenty-four hours, then rallied well and left the hospital at the end of two weeks in excellent condition. The wound healed by primary union. The usual ileo-colitis yielded promptly to a proper diet.

DOCTOR FARR remarked that the reduction of the distal portion of an intussusception, especially of long standing, consumes more time than is warranted in these shocked little patients. One must either manipulate with the finger in the abdomen rather blindly, losing considerable time and increasing the shock already present or must eviscerate and cause greatly increased shock. The procedure of air inflation is done during the giving of the anæsthetic. It requires but a moment, causes no shock, and at once relieves a large portion of the bowel from the pressure on its circulation. In this particular case the intussusception was entirely reduced, but it would be highly unwise to rely upon such a result as a rule. It at once shortens the operation by about one-half, and lessens the shock to a very marked degree. The use of air rather than water is recommended because air is completely elastic and can scarcely do any damage, and because it will instantly leave the bowel through the rectal tube on relaxation of the pressure on the syringe. This further aids in the performance of the laparotomy.

This on a somewhat similar procedure he had now used in three cases with excellent success, two complete reductions and one partial. The use of enemata for the reduction of intussusception is very old and would still be justifiable in circumstances prohibiting a laparotomy. It would hardly suffice in an intussusception of the small bowel. The use of a barium enema for diagnostic purposes as well as partial reduction of the intussusception has also been tried with success.

CONTUSION OF THE ABDOMEN

DOCTOR FARR presented three cases of contusion of the abdomen.

CASE I—A man forty-six years of age entered New York Hospital service of Doctor Gibson November 19 1925. He had been struck in the left lower abdomen by the pole of a wagon four hours before admission. There was very severe pain immediately with profuse sweating. Twenty minutes later he vomited a half cup full of blood and had a profuse cold sweat. The pain by degrees gradually became localized in the left lower abdomen. When admitted pain was confined only to this spot and was